The Brookings Project on
U.S. Relations with the Islamic World

ANALYSIS PAPER
Number 12, April 2008

A New Millennium of Knowledge?

The Arab Human Development Report on Building a Knowledge Society, Five Years On

Kristin M. Lord

Saban Center at Brookings

Expert Advisers:

Abdalla A. Alnajjar
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Abbreviations and Acronyms

AHDR	Arab Human Development Report
ASTF	Arab Science and Technology Foundation
COMSTECH	Committee on Science and Technological Cooperation [for the OIC]
ESCWA	[United Nations] Economic and Social Commission for Western Asia
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GNI	Gross National Income
ITU	International Telecommunications Union
ICT	Information and Communication Technology
KAUST	King Abdullah University of Science and Technology
MENA	Middle East and North Africa
OECD	Organization for Economic Co-operation and Development
OIC	Organization of the Islamic Conference
OPEC	Organization of the Petroleum Exporting Countries
R&D	Research and Development
S&T	Science and Technology
TIMSS	Trends in International Mathematics and Science Study
TOKTEN	[United Nations] Transfer of Knowledge Through Expatriate Nationals
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

EXECUTIVE SUMMARY

Building dynamic, innovative, and flexible economies that add value through the creative application of human initiative is now a central challenge of all societies. The challenge is particularly acute in the Arab world. As a group, these 22 countries lag other regions—and their own potential—in educational achievement, scientific advances, and economic growth. By all accounts, this situation is troubling. Arab countries, as diverse as they are, share a history of remarkable intellectual and scientific achievement. Their societies are brimming with young people who typically adapt easily and willingly to technological change. Yet, under-employment is high and human potential is under-tapped.

In 2003, the United Nations Development Programme published a widely read and controversial study that examined the region's progress in developing the knowledge, skills, and institutions rewarded in today's global economy. The study, entitled the *Arab Human Development Report 2003: Building a Knowledge Society*, presented a comprehensive explanation for the "knowledge deficit" and equally comprehensive prescriptions for reform. These reforms, the report emphasized, must be driven by Arabs. But openness and deeper engagement with the world is essential.

This study assesses what has happened in the five years since the 2003 report was published, what successes towards building a knowledge society have been achieved, what work remains, and what has failed. It analyzes what has occurred in the last five years in terms of governance, education, science and technology, knowledge-based industry, and building a knowledge culture. Drawing on the insights of a distinguished group of experts, it then recommends tangible steps toward achieving the vision of a knowledge society in the coming five years.

Our conclusion is that Arab countries, as a group, have made significant progress in most of these areas, especially compared with their own history. Yet, other regions have advanced even faster and tremendous challenges—such as creating 100 million new jobs for the region's mushrooming youth population—loom ahead. The Arab world must reinvigorate its efforts or be left behind. Many new initiatives are underway, but it is too soon to assess their impact. Success, ultimately, will be judged by what is achieved, not by what is invested.

Arab societies *have* achieved success in some areas. Access to education improved markedly in the past several years. An Arab country surpassed the global average in 8th grade science scores for the first time; others show new commitment to assessment and change. New universities with global standards are enrolling students. Governments are investing more in research and development. Economic growth is robust across much of the region and high technology exports are rising. More oil

wealth now stays in the region, invested in education, research, innovation, and productive industry. New philanthropy supports these ends.

Concerns remain. In countries across the Arab region, growing censorship threatens the development of a knowledge society. The quality of education lags and educational institutions inadequately prepare young people for jobs. Arab science and technology institutions are underfunded and still too weak. Knowledge-based industries suffer from an insufficient information and communication infrastructure, a high cost of doing business, and rigid labor markets. Intraregional trade trails other world regions. Arab societies still undervalue creativity and innovation. High levels of illiteracy endure.

To bridge the divide between the world's most developed knowledge societies and aspiring knowledge societies, mere progress is insufficient. As the 2003 Arab Human Development Report emphasized, a path of exponential growth is necessary in order to create a knowledge society—and widely enjoyed human development—in the Arab world. This future is possible. Arab societies contain vast human potential. They are vigorous with youth and vessels of a proud heritage of knowledge. Arabs can chart a new course and achieve a new Millennium of Knowledge. But this future will not come easily. Arabs must build this future with their own commitment and talents, supportive of each other, and engaged with the world.

INTRODUCTION

Knowledge lights the lamps that point out the way on the Arab journey to the future.

Arab Human Development Report, 2003

Building dynamic, innovative, and flexible economies that add value through the creative application of human initiative is now a central challenge of all societies. The challenge is particularly acute in the Arab world. As a group, these 22 countries lag other regions—and their own potential—in educational achievement, scientific advances, and economic growth. By all accounts, this situation is troubling. Arab countries, as diverse as they are, share a proud heritage of intellectual and scientific achievement. Their societies are brimming with young people who typically adapt easily and willingly to technological change. Yet, under-employment is high and human potential is under-tapped.

In 2003, the United Nations Development Programme published a widely read and controversial study that examined the region's progress in developing the knowledge, skills, and institutions rewarded in today's global economy. The study, entitled the *Arab Human Development Report 2003: Building a Knowledge Society*, presented a comprehensive explanation for the "knowledge deficit" and equally comprehensive prescriptions for reform. These reforms, the report emphasized, must be driven by Arabs. But openness and deeper engagement with the world is essential.

This study recognizes and applauds the breadth, depth, and impact of the 2003 report. It does not seek to replicate it and, indeed, there is no need to do so. Much of the 2003 report's analysis rings true today. Our goal, instead, is to assess what has happened in the five years since the report was published, what successes towards building a knowledge economy have been achieved, what work remains, and what has failed. Drawing on the insights of a distinguished group of experts, it then recommends tangible steps for further progress in the coming five years.

The 2003 report points to underlying issues of governance that obstruct a knowledge society. We recognize these obstacles and support reform; all societies should respect the rights of their citizens and facilitate creative and productive pursuits. Relative to other world regions, Arab countries are particularly deficient in terms of freedom of expression, assembly, and political participation. Nonetheless, slow progress in political reform should not stop movement towards a knowledge society. Though knowledge thrives in freedom, important steps toward that end must be taken in the meantime.

We embark on this study for five reasons:

- The United Nations published the Arab Human Development Report (AHDR) on building a knowledge society a half decade ago. It is time to look back at that original report and reflect on the state of the region today.

- We see progress that must be acknowledged and promises that must still be fulfilled.

- We fear the implications of an Arab world that continues to fall behind.

- The world continues to evolve in ways that favor knowledge societies. We wish Arab societies to share these rewards.

- We believe in the power of education, science, and knowledge to improve lives and enrich the human experience.

Knowledge increasingly defines the line between wealth and poverty, between capability and powerlessness and between human fulfillment and frustration. A country able to mobilize and diffuse knowledge can rapidly raise its level of development, help all its citizens to grow and flourish and take its proper place on the 21st century global stage.

—Rima Khalaf Hunaidi, former Regional Director, Arab States, UNDP

The Arab Human Development Report on Building a Knowledge Society

The 2003 AHDR on Building a Knowledge Society is part of a larger four-part analysis of challenges facing the Arab world. The reports use human development as a lens, a concept that extends far beyond economic gain. At any level of economic development, the argument goes, humans have three basic requirements: "to live a long and healthy life, to acquire knowledge, and to possess resources necessary for a decent life." These requirements, while necessary for human development, are not sufficient. Human development also includes "political, economic and social freedoms, opportunities for production and creativity, the enjoyment of liberty, self-fulfillment, and respect for human rights." The building of a knowledge society—defined as a society in which "knowledge diffusion, production and application become the organizing principle in all aspects of human activity: culture, society, the economy, politics, and private life"—is viewed as a step forward on the path of human development.[1]

The report looked forward, presenting a strategic vision to strengthen the five pillars of an Arab knowledge society:

- a climate of free and creative expression
- high-quality education at all levels
- a deep commitment to science and scientific research
- productive knowledge-based industry
- a culture of learning and innovation.

It praised positive moves towards a knowledge society, especially in the arts and the information environment. It also criticized shortcomings—and their roots in governance, economic priorities, society, culture, media, and even the Arabic language.

The authors of the 2003 AHDR hoped that this vision would be "taken up, nurtured and debated by human development advocates within Arab society, recognizing and paying attention to dissenting views. Where the vision is adopted, a consensus on priorities needs to be accompanied by decisions for implementing the strategic vision under the specific conditions of that society." Their underlying premise is that, "The future map of the Arab world must be drawn from within the region."[2] We concur with this vision and submit this report as a catalyst for dialogue—and hopefully action.

Arab Human Development Report Countries	
Algeria	Morocco
Bahrain	Oman
Comoros	Palestine
Djibouti	Qatar
Egypt	Saudi Arabia
Iraq	Somalia
Jordan	Sudan
Kuwait	Syria
Lebanon	Tunisia
Libya	UAE
Mauritania	Yemen

[1] *Arab Human Development Report 2003: Building a Knowledge Society* (New York: United Nations Development Programme, 2003), p. 17. Hereafter referred to as "AHDR 2003", p. 17.
[2] AHDR, p. 163.

About this report

This report is both descriptive and prescriptive. It first presents the state of the evolving Arab knowledge society, using the 2003 AHDR as a baseline. Then, drawing on that analysis, the original report, and the advice of our expert advisors and others, it presents recommendations for how to promote the Arab knowledge society in the *next* five years. Like its ambitious predecessor, these recommendations are presented to stimulate dialogue and debate. Building knowledge societies is a task no country has mastered. Successful countries learn what they can from others but, ultimately, each society must find its own way.

Where possible, we evaluate data from the same sources employed by the 2003 AHDR. Where no new data has been collected, we sought similar data and use it to compare the knowledge society in 2003 to its status today. The data are inadequate to the task—as they were in 2003. Indeed, the 2003 AHDR called poor data on knowledge in the Arab world "one of the most press-

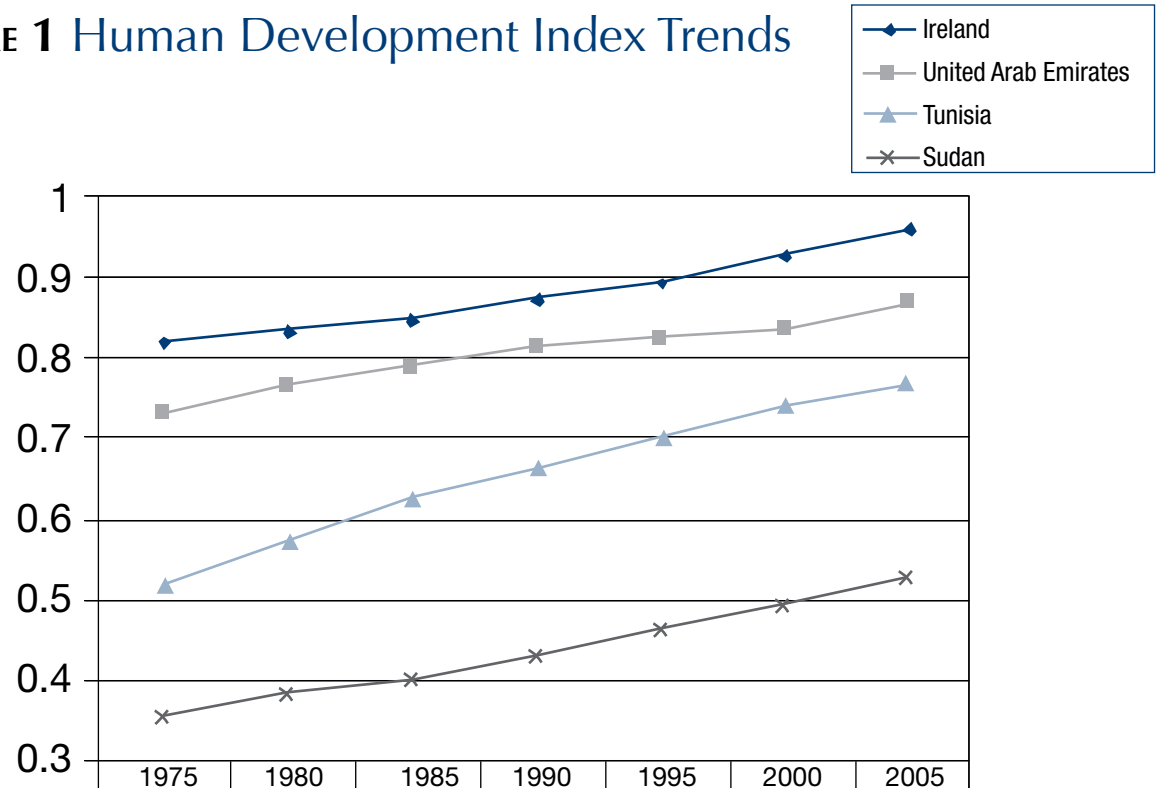
Table 1 Human Development Index Trends, Arab Countries and Comparators

2007 HDI		1975	1980	1985	1990	1995	2000	2005
HIGH HUMAN DEVELOPMENT								
5	Ireland	0.823	0.835	0.851	0.875	0.898	0.931	0.959
33	Kuwait	0.771	0.789	0.794	-	0.826	0.855	0.891
35	Qatar	-	-	-	-	-	-	0.875
39	UAE	0.734	0.769	0.790	0.816	0.825	0.837	0.868
41	Bahrain	-	0.747	0.783	0.808	0.834	0.846	0.866
42	Slovakia	-	-	-	-	-	-	0.863
58	Oman	0.487	0.547	0.641	0.697	0.741	0.779	0.814
61	Saudi Arabia	0.611	0.666	0.684	0.717	0.748	0.788	0.812
MEDIUM HUMAN DEVELOPMENT								
86	Jordan	-	0.647	0.669	0.684	0.710	0.751	0.773
87	Peru	0.647	0.676	0.699	0.710	0.737	0.763	0.773
88	Lebanon	-	-	-	0.692	0.730	0.748	0.772
89	Ecuador	0.636	0.678	0.699	0.714	0.734	-	0.772
91	Tunisia	0.519	0.575	0.626	0.662	0.702	0.741	0.766
104	Algeria	0.511	0.562	0.613	0.652	0.672	0.702	0.733
106	Palestinian Territories	-	-	-	-	-	-	0.731
108	Syria	0.547	0.593	0.628	0.646	0.676	0.690	0.724
112	Egypt	0.434	0.482	0.532	0.575	0.613	0.659	0.708
114	Mongolia	-	-	0.637	0.654	0.638	0.667	0.700
126	Morocco	0.435	0.483	0.519	0.551	0.581	0.613	0.646
134	Comoros	-	0.483	0.500	0.506	0.521	0.540	0.561
137	Mauritania	0.383	0.410	0.435	0.455	0.487	0.509	0.550
147	Sudan	0.354	0.381	0.400	0.429	0.463	0.491	0.526
149	Djibouti	-	-	-	0.476	0.485	0.490	0.516
153	Yemen	-	-	-	0.402	0.439	0.473	0.508
LOW HUMAN DEVELOPMENT								
159	Tanzania	-	-	-	0.421	0.419	0.433	0.467

NOTE: The human development index values in this table were calculated using a consistent methodology and data series. They are not strictly comparable with those in earlier Human Development Reports.

Source: UNDP Human Development Report, 2007/2008.

Figure 1 Human Development Index Trends



	1975	1980	1985	1990	1995	2000	2005
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Tunisia	0.519	0.575	0.626	0.662	0.702	0.741	0.766
Sudan	0.354	0.381	0.4	0.429	0.463	0.491	0.526

Source: UNDP Human Development Report, 2007/2008.

ing priorities in building the Arab knowledge society." There are plans to rectify this problem in the future; we have culled what we could in the meantime. Longitudinal data, the measurement of the same factors over time, are particularly scarce, which complicates efforts to measure progress and change.[3]

Finally, this report is modest. The original report had enormous breadth, employing a team of more than 100 scholars and experts, and focusing on international politics, religion, language, history, culture, and society as well as science, scholarship, industry, and international relations. This report will focus only on selected elements of the AHDR, especially those most directly related to the five pillars of the Arab knowledge society.

The Region in Summary

Twenty-two countries comprise the Arab region, home to over 310 million people and 10% of the world's land area. These countries are wildly diverse by almost every measure: rich and poor, large and small, stable and unstable, populous and sparsely populated, traditional and modern.

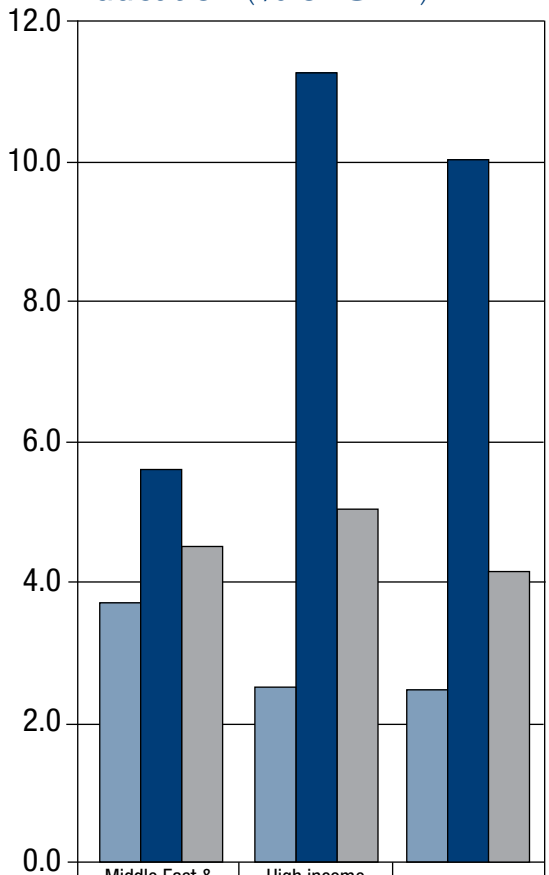
This diversity extends to human development. As Table 1 demonstrates, the level of human development varies widely across the Arab world. Six countries—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE—achieved "high human development," while the remaining Arab countries feature medium human development according to the 2007/2008 UNDP Human

[3] This call for better data is echoed by the journal, *Nature*, which extends this generalization to the 57 members of the Organization of the Islamic Conference, not just the 22 Arab states. See Declan Butler, "The Data Gap," *Nature,* Vol. 444 (November 2, 2006), p. 26.

Development Report. Over time, the region's level of human development has increased.

As a group, Arab countries are thriving economically after decades of sluggish growth. Real GDP per capita increased 4% per year from 2004-2006, up from 2.6 % earlier in the decade and 1.7% in the 1990s. Much, but not all, of this growth derives from lucrative oil exports, now selling at over $120 per barrel. Economies are also diversifying, a promising new trend, and some countries—such as the UAE—are becoming major world centers of investment and commerce.

FIGURE 2 Government Expenditure on Military, Health, and Education (% of GDP)



	Middle East & North Africa	High income OECD	World
Military Expenditure	3.74	2.54	2.50
Health Expenditure	5.64	11.31	10.05
Public Spending on Education	4.55	5.08	4.21

NOTE: Values for military expenditure are from 2005, health from 2004, and those for education are from 1999.

Source: World Bank Development Indicators, 2007.

Despite this growth, unemployment remains higher than in any other world region. Youth struggle the most. First time job seekers, aged 15-24 years of age, make up more than 50% of the Arab region's unemployed.[4] While still quite high in global terms, unemployment has declined. Unemployment in North Africa declined from 13.7% in 2002 to 11.5% in 2006. In the Middle East unemployment declined from 13% to 12.1% in the same period.[5]

Unresolved political conflicts continue to roil the region. In Iraq, Lebanon, Palestine, Somalia, and Sudan these conflicts have erupted in violence. Terrorist attacks remain a threat in Algeria, Egypt, Jordan and Saudi Arabia. Concerns about nuclear weapons proliferation in the region persist. Military budgets are large.

The region is young, with 35% of the population under age 15. Demography is therefore a major opportunity as well as a major challenge. Though young populations can fuel growth and create dynamic societies, too few schools, universities, jobs, and opportunities await these young people. To employ these new job seekers, the region must create 100 million new jobs by 2020, according to the World Bank.

As in 2003, the region lags well behind the world in the production of knowledge. There is a shortage of quality higher education institutions and research organizations. Patents and scientific research, just two measures of scientific progress, do not meet global standards. According to the Mohammed bin Rashid Al Maktoum Foundation, in one year the 22 Arab countries produce 6,000 books while North America produces 102,000 books.

The region has made progress toward building a knowledge society since 2003. However, the rest of the world is advancing faster, at unprecedented rates. The explosive growth of China and India, as well as the less cel-

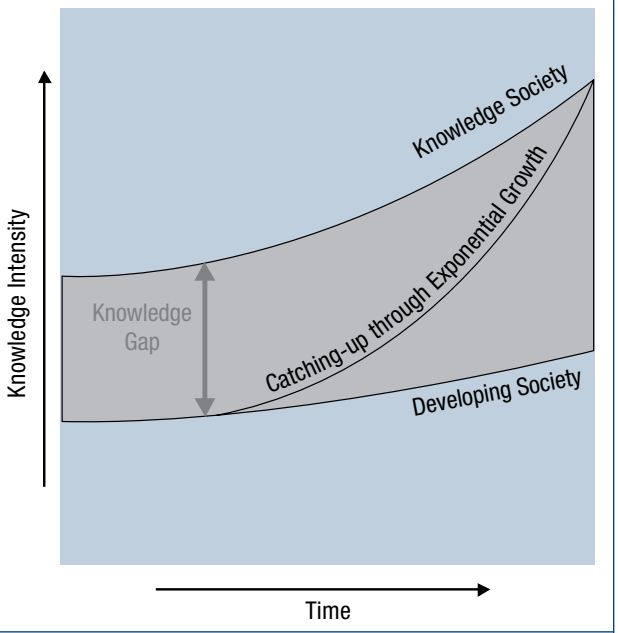
[4] Middle East Youth Initiative, A Joint Initiative of the Wolfensohn Center for Development at Brookings and the Dubai School of Government, www.shababinclusion.org/section/topics/employment (accessed April 21, 2008).
[5] *Key Indicators of the Labour Market, 5th ed.* (International Labor Organization).

Table 2 Demographic Trends

	Total population (millions)			Annual population growth rate		Population under age 15 (% of total)	
Region	**1975**	**2005**	**2015**	**1975-2005**	**2005-2015**	**2005**	**2015**
Arab states	144.4	313.9	380.4	2.6	1.9	35.2	32.1
Latin America and the Caribbean	323.9	556.5	626.5	1.8	1.2	29.8	26.3
Central and Eastern Europe and CIS	366.6	405.2	398.6	0.3	-0.2	18.1	17.4

Source: United Nations Human Development Report 2007/2008

Figure 3 Bridging the Knowledge Gap through Expontential Growth in Knowledge Acquisition



This Figure is reproduced from *Arab Human Development Report 2003: Building a Knowledge Society*, Figure 1.1, p. 40.

ebrated progress of Vietnam, Eastern Europe, and parts of Latin America, is simply outpacing the progress of Arab countries as a group.

To bridge the divide between the world's most developed knowledge societies and aspiring knowledge societies, the developing and the rapidly developing, mere progress is insufficient. As indicated in the 2003 AHDR, a path of exponential growth is necessary in order to create a knowledge society—and widely enjoyed human development—in the Arab world.

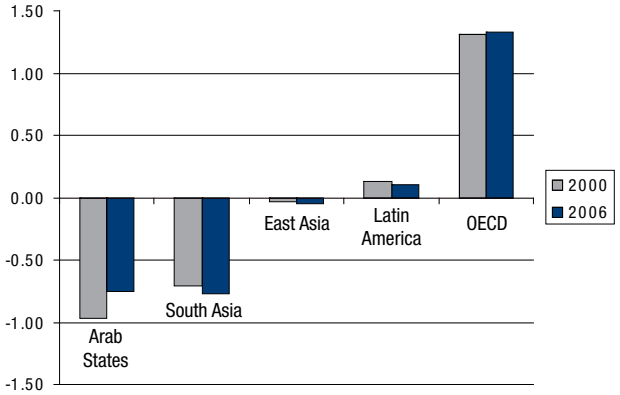
GOVERNANCE

Strategic Vision: Unleashing and Guaranteeing the Key Freedoms of Opinion, Speech and Assembly through Good Governance

The 2003 AHDR called for the creation of an "independent knowledge sphere" in which knowledge can be produced and shared without political interference. The foundation of this knowledge sphere, it argued, are freedoms of opinion, speech, and assembly that "ensure the viability of scientific research, technological development, and artistic and literary expression, all of which are means of producing knowledge."[6] Though scientific and technological advancement is indeed possible under oppressive regimes, these gains rarely extend into human and social sciences, literature, or the arts. Cutting edge innovation is more likely to thrive—and endure—in open societies. Most importantly, gains in knowledge production are less likely to permeate the entire society, obstructing the human development of the population at large.

By these standards, the region's experience since 2003 is mixed. As indicated in Figure 4, overall measures of voice and accountability increased compared to the data reported in 2003. That progress masks large differences between countries. Seven countries—Algeria, Bahrain, Comoros, Iraq, Qatar, Saudi Arabia, and Syria—improved. However, 15 of 22 Arab countries registered declines in voice and accountability between 2000 and 2006. Jordan, Libya, Morocco, and the UAE registered the largest declines.

FIGURE 4 Change in Voice and Accountability Rating, 2000/2006



NOTE: Each year, the Worldwide Governance Indicators project at the World Bank computes a Voice and Accountability rating for each country. Voice and Accountability measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The data is drawn from surveys of firms and individuals, as well as the assessments of commercial risk rating agencies, non-governmental organizations, and multilateral aid agencies and other public sector organizations.

Source: Worldwide Governance Indicators: 1996-2006. The World Bank. Available at www.govindicators.org.

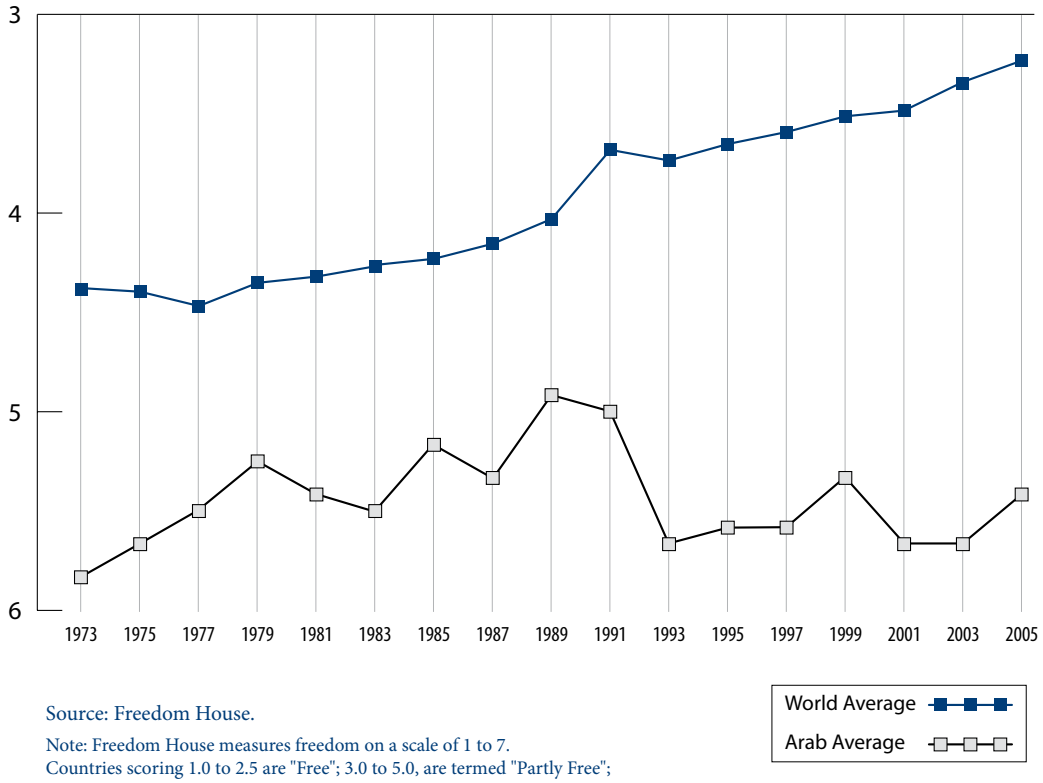
As indicated in another analysis paper published by the Saban Center for Middle East Policy at the Brookings Institution, these measures reflect a new trend towards "upgraded authoritarianism."[7] This new brand of au-

[6] AHDR 2003, p. 165.
[7] Steve Heydemann, *Upgrading Authoritarianism in the Arab World,* Analysis Paper Number 13 (Washington DC: Saban Center for Middle East Policy at The Brookings Institution, October 2007).

thoritarian governance is more flexible and, in some ways, more pluralistic than past models. It combines economic liberalization; controlled participation by opposition groups; the selective cooption of civil society groups; and the selective censorship of communication, especially via the Internet.[8] Figure 5, prepared by Brookings analyst Steven Heydemann, compares Freedom House's measures of democracy in four Arab countries to the world average, and shows a significant gap between the region and the global mean.

Compared to 2003, censorship has new dimensions. Considered an uncontrollable medium of communication in the 1990s, the Internet is more susceptible to control than earlier imagined. Social, legal, and technical tools (though imperfect) are all available to regimes that wish to connect with the world—but only on their terms.[9] Bloggers in the region increasingly face prosecution, as evidenced by recent arrests in Saudi Arabia, Egypt, and Tunisia.[10] Even satellite television, which has become a vibrant forum for the exchange of ideas and a highly competitive industry, faces new constraints.[11] The cost of this censorship is not only that it curtails expression among the sanctioned, but also that it chills expression among much larger numbers who censor themselves.

FIGURE 5 Democracy in the Arab World (Algeria, Egypt, Morocco, Tunisia)



Source: Freedom House.

Note: Freedom House measures freedom on a scale of 1 to 7. Countries scoring 1.0 to 2.5 are "Free"; 3.0 to 5.0, are termed "Partly Free"; and 5.5 to 7.0 are deemed "Not Free". See "Freedom in the World Frequently Asked Questions," (Washington D.C., Freedom House, 2007), available at: <http://www.freedomhouse.org/template.cfm?page=277>.

Chart reproduced from Steve Heydemann, *Upgrading Authoritarianism in the Arab World*, p. 6.

[8] Despite this setback, over the past two decades, the overall trend has seen increased popular participation and more space for freedom of expression. For a discussion see Amr Hamzawy and Nathan Brown, "Arab Spring Fever," *The National Interest* online (August 27, 2007).

[9] For an analysis, see Kristin M. Lord, *Perils and Promise of Global Transparency: Why the Information Revolution May Not Lead to Security, Democracy, or Peace* (SUNY Press, 2006).

[10] Faiza Saleh Ambah, "Dissident Saudi blogger is arrested," *The Washington Post* (January 1, 2008), p. A7. For a more extensive discussion, see "False freedom: online censorship in the Middle East and North Africa," Human Rights Watch (November 2005).

[11] James Robnison, "Al Jazeera head attacks Arab League," guardian.co.uk (February 19, 2008).

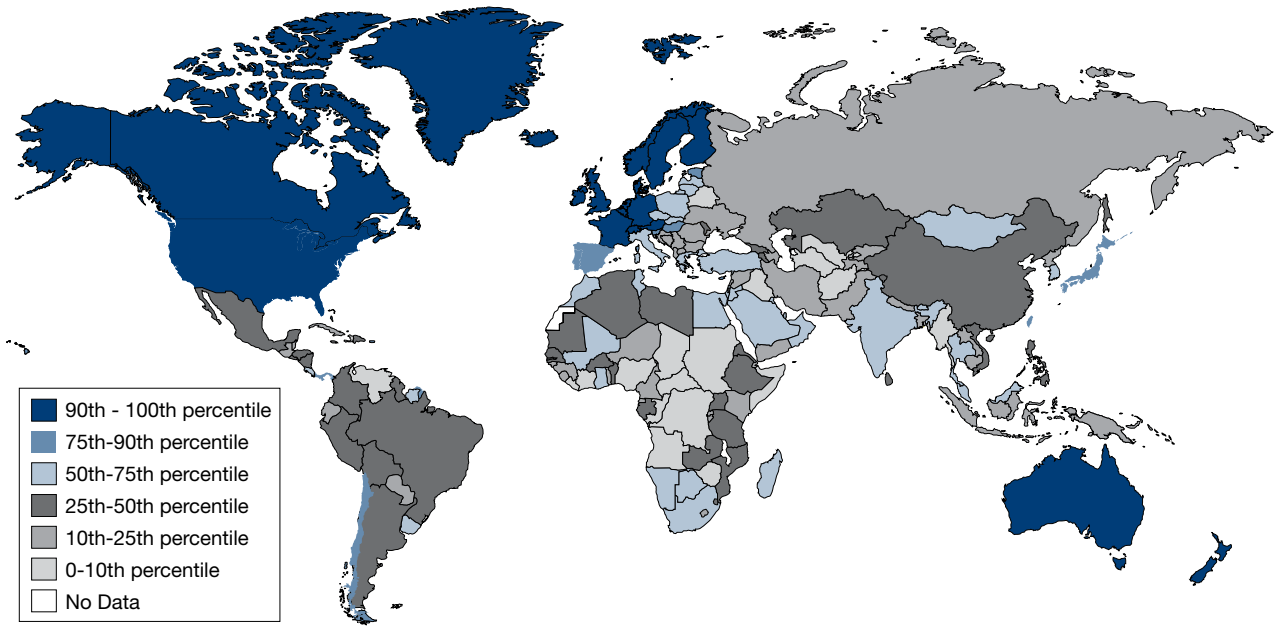
The Arab development crisis is so acute, complex and multifaceted that a knowledge renaissance cannot be constructed in isolation, and will be impossible in the absence of broader reforms touching almost all aspects of Arab society – in cultural constructs, social and economic systems, and above all in the political structures at the national, regional and global scales. . . . The developed world is rapidly forging ahead in creating knowledge-intensive societies. If the Arab world does not quickly reform, the asymmetry of world knowledge production will continue, and the Arab countries will be forever marginalized.[12]

—Nader Fergany, lead author, Arab Human Development Reports

The 2003 AHDR called for the fair and predictable rule of law. On this measure, the performance of Arab countries is mixed. As indicated in Figure 6, no Arab country ranks above the 75th percentile in global measures of the rule of law and several rank well below that standard. Of note, measuring the rule of law in the Middle East and North Africa is growing more complex. Instead of flouting laws, regimes increasingly use legal reform as a tactic of control. Since 2002, Egypt, Morocco, and Jordan have all reformed laws to restrict civil society and rights of association.[13]

Corruption thrives where the rule of law is weak. As indicated in Figure 7, control over corruption varies widely across the Arab world. In absolute terms, corruption is most prevalent in Iraq, West Bank/Gaza, Libya, and Djibouti. It is least prevalent in the Gulf countries of the UAE, Qatar, and Oman. There has been some positive change since 2000, according to The World Bank. Algeria, Comoros, Djibouti, Jordan, and the UAE registered significant positive improvements. However, as indicated in Figure 7, fourteen Arab states declined on this measure.

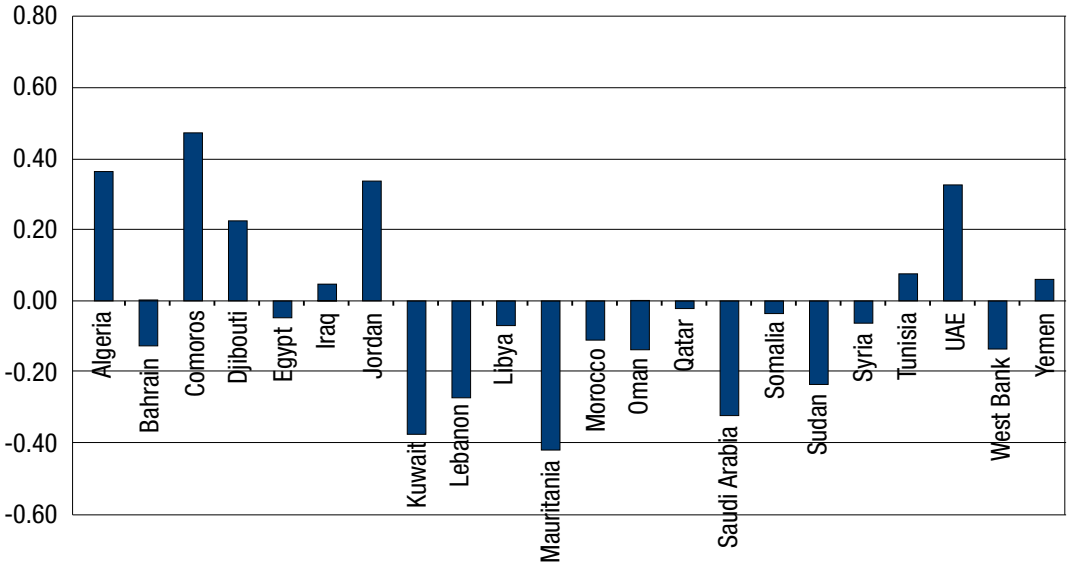
Figure 6 Rule of Law



Source: Worldwide Governance Indicators, 1996-2006. The World Bank. Available at www.govindicators.org.

[12] Nader Fergany, "Steps toward reform," *Nature*, Vol. 444 (November 2, 2006), p. 33.
[13] See Heydemann, p. 13.

Figure 7 Change in Control of Corruption Rating, 2000/2006



NOTE: Each year, the Worldwide Governance Indicators project at the World Bank computes a Control of Corruption rating for each country. Control of Corruption measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. The Governance Matters data sources consist of surveys of firms and individuals, as well as the assessments of commercial risk rating agencies, non-governmental organizations, and a number of multilateral aid agencies and other public sector organizations.

Source: Worldwide Governance Indicators: 1996-2006. The World Bank. Available at www.govindicators.org.

"Knowledge and freedom are two sides to the same coin . . . building communities of knowledge requires the development of policies, laws and measures necessary to ensure the freedom of thought, research, publication, in addition to providing protection for intellectuals, researchers, and inventors, while securing the independence of universities and research centers."[14]

—Sheikh Mohammad Bin Rashid Al Maktoum, Prime Minister, UAE

[14] Sheikh Mohammad Bin Rashid Al Maktoum, speech to Knowledge Conference in Dubai, October 28, 2007. See: archive.gulfnews.com/articles/07/10/28/10163394.html (accessed April 21, 2008).

EDUCATION

Strategic Vision: Disseminating high quality education for all

Excellence in education is an essential feature of knowledge societies. The 2003 AHDR thus devoted considerable energy to this subject, taking a comprehensive view that included formal and informal learning throughout the course of human development. It focused on early childhood and primary school education, tertiary education, higher education, and life-long learning.

There is some progress to report on these measures—but less than the AHDR authors would have hoped. Progress has come largely in expanding access to education, undoubtedly an important achievement, and less improving of quality and student performance. Higher education is an area of intense activity and change, but it is too soon to assess the impact of recent investments.

FIGURE 8 Average Mathematics and Science Scores of Eighth-grade Students from 1999/2003 TIMSS, All Participating Arab Countries

	1999				2003			
Country	Math	Math Rank (out of 38)	Science	Science Rank (out of 38)	Math	Math Rank (out of 45)	Science	Science Rank (out of 45)
World Average (participating countries)	487	-	488	-	466	-	473	-
Lebanon	-	-	-	-	433	31	393	41
Jordan	428	32	450	30	424	32	475	25
Tunisia	448	29	430	34	410	35	404	38
Egypt	-	-	-	-	406	36	421	35
Bahrain	-	-	-	-	401	37	438	33
Palestinian National Authority	-	-	-	-	390	38	435	34
Morocco	337	37	323	37	287	39	396	40
Saudi Arabia	-	-	-	-	332	43	398	39

NOTE: Additional Arab countries participated in 2007 testing (results not yet released): Algeria, Dubai (United Arab Emirates), Kuwait, Oman, Qatar, Syrian Arab Republic, Yemen.

Source: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 1995, 1999, and 2003. Full reports available at: nces.ed.gov/pubs2001/2001027.pdf and nces.ed.gov/pubs2005/2005005.pdf.

Jordan Education Initiative

The Jordan Education Initiative (JEI), launched in June 2003, is a public-private partnership of 30 global and local organizations from the public, private, and non-profit sectors. Its mission is to improve education in Jordan, using information and communications technologies, and to build the capacity of local technology companies and create a model for reform that could be adopted by other countries. JEI intends to promote innovation in both the classroom, using digital content, and outside the classroom, by employing local workers in software development. A frequently cited example of a successful public-private partnership, this formula has been copied in Bahrain and Pakistan and is being closely watched elsewhere.

In the JEI's first two years, it developed a "Math e-Curriculum," introduced technology and teacher training to fifty schools, and transferred approximately $3.7 million dollars to local companies to work on JEI programs. The pilot programs reached approximately 2,300 teachers and 50,000 students. The e-Curriculum combines lesson plans, media, student assignments and assessment tests, and professional development materials for teachers.

The consulting firm McKinsey & Company published an evaluation of the JEI in 2005. However, it did not assess the educational impact of the program—arguably the most important measure of success. An evaluation by the British Council and University of Keele is planned.

In terms of building the local information technology industry, the JEI registered some tangible achievements. Local companies received contracts worth $3.7 million in the first two years of the project. Successful work on these contracts led to other opportunities. Cisco Systems launched a partnership with the Jordanian firm Estarta to develop a technical support center to serve customers in Europe and the Middle East. That investment was successful, leading Cisco to invest further in Jordan.

Arab countries spend an average of 5% of GDP on education, which is higher than the average of 3% spent by countries in East Asia or Latin America.[15] This commitment to education is admirable. However, the return on this investment is currently not high. Standardized tests show lagging academic achievement, despite the significant expenditure. A 2008 World Bank study attributes the gap between investment and educational outcomes to three main causes: an insufficient focus on the quality of education, too little public accountability, and inadequate inventives to improve teaching.[16]

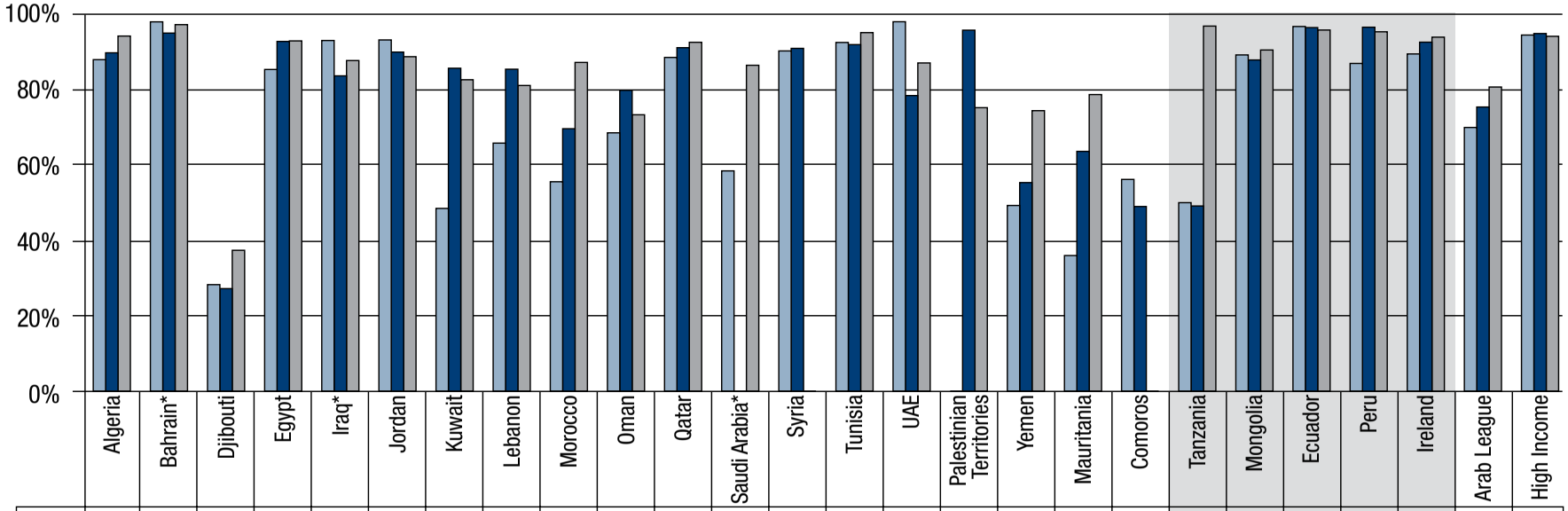
Improving learning in early childhood: The 2003 AHDR called for better pre-school education in kindergartens and within Arab households. Stimulating the intellects and creativity of young children, the report argued, lays the groundwork for future learning. The status, impact, and quality of such experiences is extremely difficult to measure—and indeed the 2003 report did not attempt to do so. Undoubtedly, the availability of stimulating childhood experiences influences the building of knowledge societies. However, creating measures to assess progress is beyond the scope of this study.

Universal basic education for all, extended to grade ten at least: The 2003 AHDR recognized enormous progress in expanding access to education in the 20th century. That progress endures today, with access to primary education rising in 13 of 22 Arab countries. Yemen achieved one of the most impressive gains, increasing access to primary education from 57% to 73% between 1999 and 2005. Access to primary education in Lebanon, Oman, the UAE, and the Palestinian territories declined, as indicated in Figure 9. Twelve Arab countries improved access to tertiary education, with Bahrain and Lebanon registering the largest increases at 14% each. Access to tertiary education declined in Egypt, Kuwait, Oman, Qatar, and Yemen. Increasing access to tertiary education is necessary to meet rising global standards. As shown in Figure 10, only Lebanon and Libya exceed Mongolia in providing access to tertiary education.

Raising the quality of education at all levels: The quality of education at the primary and tertiary levels

[15] See *The Road Not Traveled: Education Reform in the Middle East and North Africa*, p. 10.
[16] See *The Road Not Traveled: Education Reform in the Middle East and North Africa.*

FIGURE 9 Primary School Enrollment, (% net)

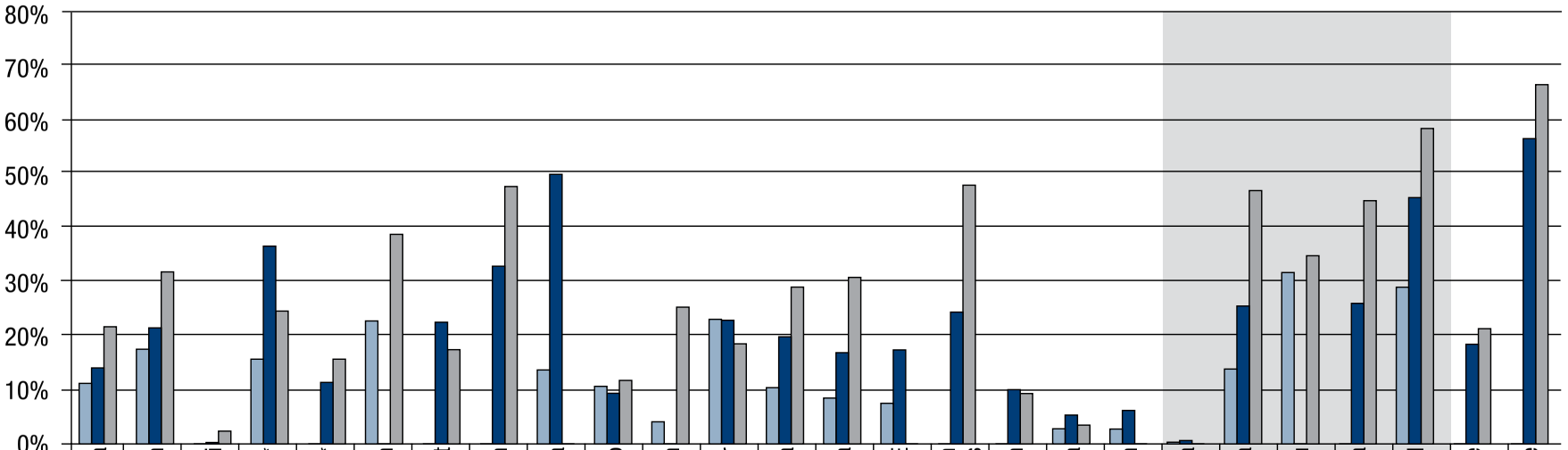


	Algeria	Bahrain*	Djibouti	Egypt	Iraq*	Jordan	Kuwait	Lebanon	Morocco	Oman	Qatar	Saudi Arabia*	Syria	Tunisia	UAE	Palestinian Territories	Yemen	Mauritania	Comoros	Tanzania	Mongolia	Ecuador	Peru	Ireland	Arab League	High Income
1991	88.85	98.99	28.55	86.22	93.99	94.14	48.98	66.48	56.13	69.24	89.45	59.04	91.19	93.46	99.02	–	49.77	36.35	56.75	50.52	90.12	97.74	87.84	90.38	70.68	95.45
1999	90.69	95.97	27.48	93.74	84.51	90.88	86.55	86.29	70.34	80.63	92.06	–	91.88	92.88	79.23	96.75	55.90	64.27	49.49	49.63	88.77	97.45	97.55	93.54	76.16	95.85
2005/ 2006	95.18	98.24	37.75	93.88	88.61	89.65	83.47	81.93	88.11	74.08	93.51	87.35	–	96.10	87.97	75.98	75.18	79.50	–	97.85	91.44	96.79	96.32	94.88	81.52	95.11

NOTE: * indicates most recent data from 2005, all others' from 2006. Insufficient data available for Libya, Somalia, and Sudan. High income defined as above $11,116 per capita (2007 USD).

Source: UNESCO Institute for Statistics, 2008.

Figure 10 Tertiary School Enrollment, (% gross)

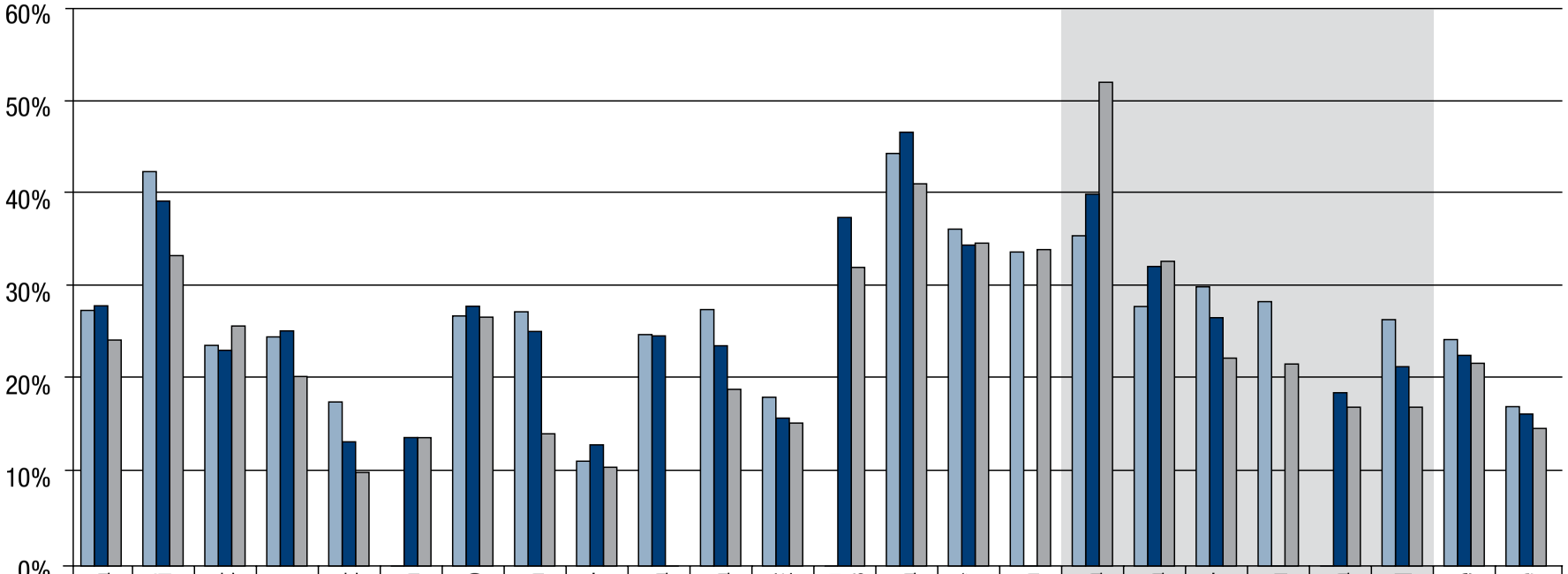


	Algeria	Bahrain	Djibouti	Egypt*	Iraq*	Jordan	Kuwait	Lebanon	Libya	Morocco	Oman	Qatar	Saudi Arabia	Tunisia	UAE	Palestinian Territories	Yemen	Mauritania	Sudan	Tanzania	Mongolia	Peru	Slovakia	Ireland	Arab League	High Income
1991	11.28	17.64	–	15.79	–	22.91	–	–	13.78	10.73	4.12	23.22	10.48	8.54	7.57	–	–	2.82	2.77	0.32	13.95	31.93	–	29.20	–	–
1999	14.16	21.62	0.27	36.85	11.46	–	22.67	33.11	50.23	9.44	–	23.04	19.96	17.00	17.51	24.56	10.11	5.37	6.24	0.63	25.69	–	26.19	45.89	18.57	56.88
2005/2006	21.83	32.05	2.38	34.75	15.79	39.05	17.56	47.96	–	11.83	25.48	18.65	29.22	31.03	–	48.21	9.39	3.50	–	–	47.20	35.06	45.32	58.77	21.47	66.94

NOTE: * indicates most recent data from 2005, all others' from 2006. Insufficient data available for Somalia, Syria, and Comoros. High income defined as above $11,116 per capita (2007 USD).

Source: UNESCO Institute for Statistics, 2008.

FIGURE 11 Pupil-Teacher Ratio, Primary School

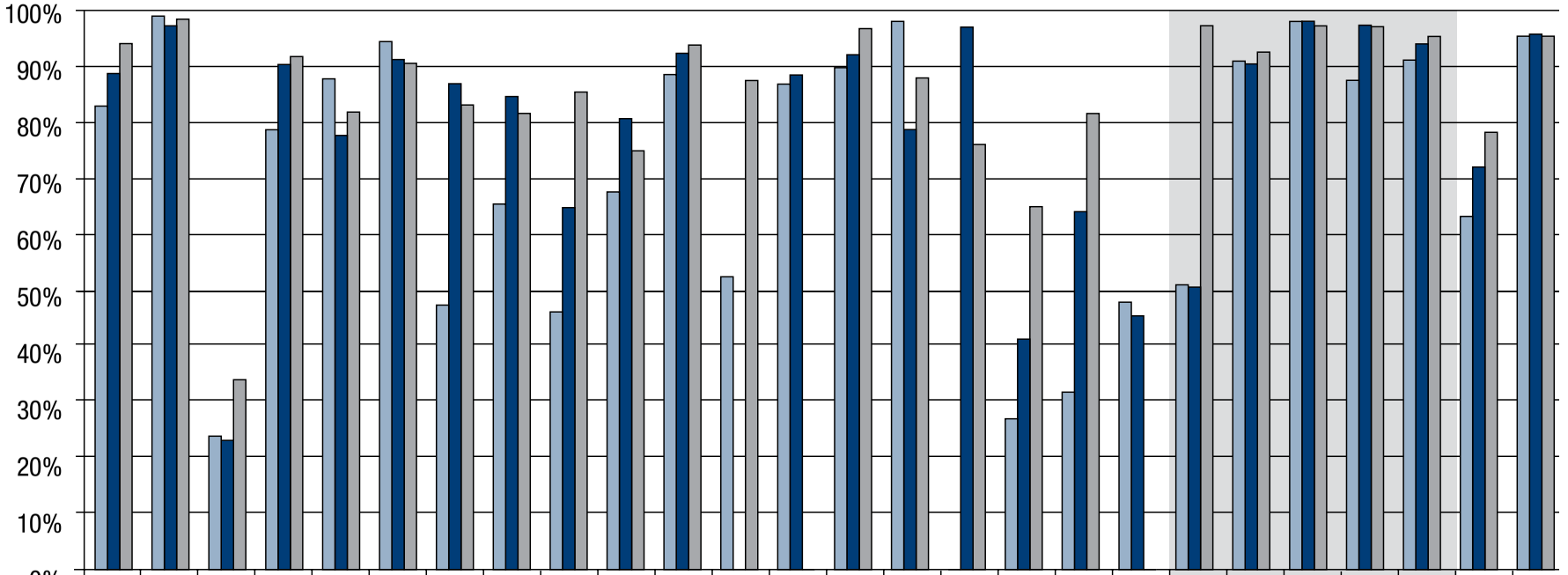


	Algeria	Djibouti	Egypt	Iraq*	Kuwait	Lebanon	Morocco	Oman	Qatar	Syria	Tunisia	UAE	Palestinian Territories	Mauritania	Comoros*	Sudan	Tanzania	Mongolia	Ecuador	Peru	Slovakia	Ireland	Arab League	High Income
1991	27.69	42.73	23.90	24.82	17.77	–	27.09	27.54	11.35	25.07	27.78	18.28	–	44.70	36.50	34.02	35.78	28.11	30.25	28.64	–	26.69	24.53	17.26
1999	28.19	39.54	23.37	25.47	13.45	13.91	28.14	25.41	13.12	24.93	23.86	16.02	37.76	47.00	34.77	–	40.28	32.45	26.90	–	18.77	21.59	22.82	16.46
2005/ 2006	24.48	33.63	26.00	20.53	10.14	13.90	26.96	14.32	10.69	–	19.14	15.48	32.35	41.41	34.98	34.28	52.41	33.01	22.52	21.88	17.20	17.20	21.96	14.90

NOTE: Low number indicates more teachers for each student. * indicates most recent data from 2005, all others' from 2006. Insufficient data available for Bahrain, Jordan, libya, Saudi Arabia, Somalia, and Yemen. High income defined as above $11,116 per capita (2007 USD).

Source: UNESCO Institute for Statistics, 2008.

Figure 12 Primary School Enrollment, Female (% net)

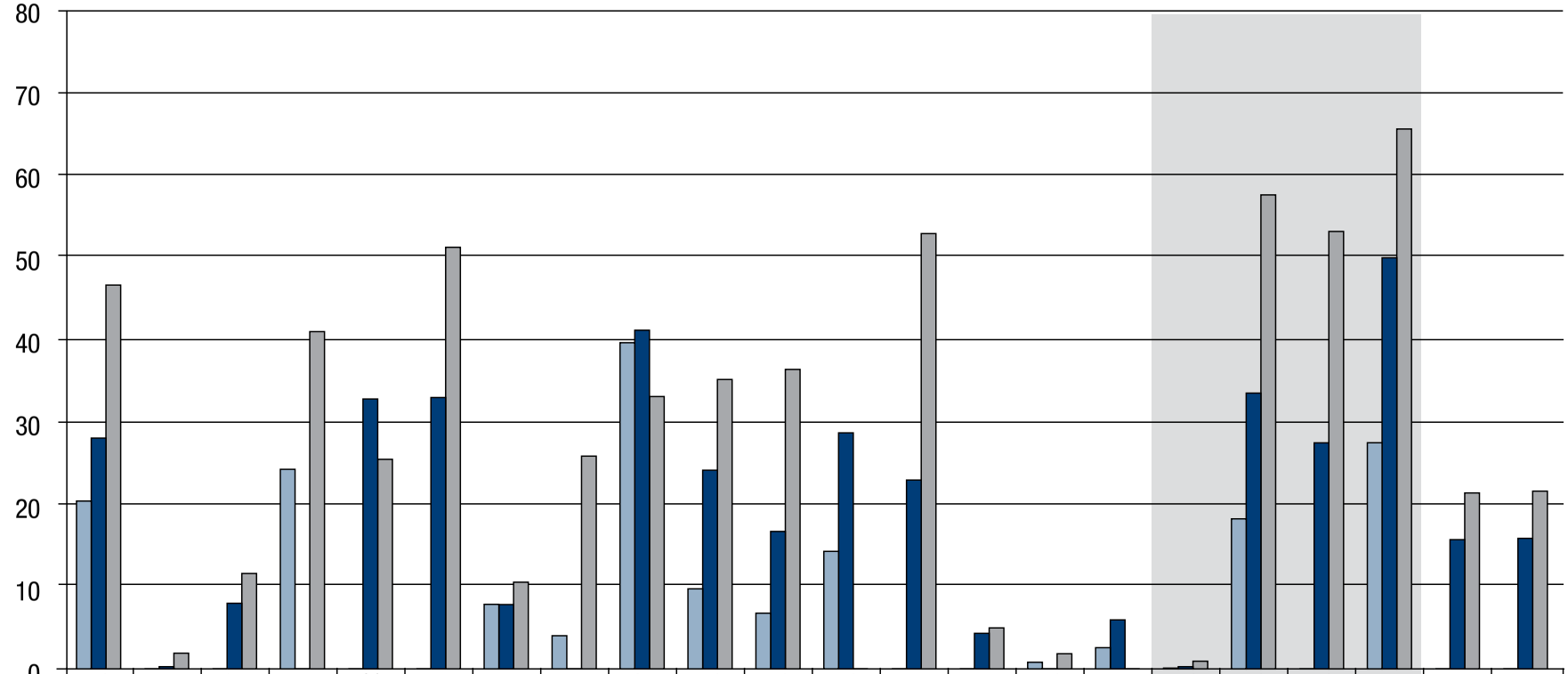


	Algeria	Bahrain*	Djibouti	Egypt	Iraq*	Jordan	Kuwait	Lebanon	Morocco	Oman	Qatar	Saudi Arabia*	Syria	Tunisia	UAE	Palestinian Territories	Yemen	Mauritania	Comoros	Tanzania	Mongolia	Ecuador	Peru	Ireland	Arab League	High Income
1991	82.86	98.95	23.85	78.63	87.73	94.39	47.28	65.34	46.06	67.51	88.50	52.34	86.79	89.73	98.00	–	26.95	31.72	47.80	50.90	90.90	97.99	87.46	91.08	63.14	95.35
1999	88.68	97.21	23.09	90.29	77.61	91.18	86.86	84.57	64.71	80.61	92.30	–	88.42	92.04	78.66	96.97	41.19	63.98	45.35	50.49	90.39	98.02	97.32	93.97	71.96	95.71
2005/2006	94.03	98.39	33.94	91.71	81.79	90.50	83.06	81.55	85.37	74.86	93.77	87.43	–	96.71	87.89	75.99	64.88	81.53	–	97.22	92.51	97.20	97.05	95.31	78.17	95.35

NOTE: * indicates most recent data from 2005, all others' from 2006. Insufficient data available for Libya, Somalia, and Sudan. High income defined as above $11,116 per capita (2007 USD).

Source: UNESCO Institute for Statistics, 2008.

FIGURE 13 Tertiary School Enrollment, Female (% gross)



	Algeria	Djibouti	Iraq*	Jordan	Kuwait	Lebanon	Morocco	Oman	Qatar	Saudi Arabia	Tunisia	UAE	Palestinian Territories	Yemen	Mauritania	Sudan	Tanzania	Mongolia	Slovakia	Ireland	Arab League	High Income
1991	20.48	–	–	24.35	–	–	7.88	4.05	39.80	9.77	6.80	14.34	–	–	0.81	2.59	0.10	18.31	–	27.59	–	–
1999	28.16	0.27	8.01	–	32.93	33.11	7.85	–	41.32	24.24	16.77	28.80	23.04	4.34	–	5.98	0.27	33.65	27.58	50.16	15.77	15.93
2006	46.83	1.92	11.64	41.15	25.57	51.44	10.58	25.96	33.23	35.31	36.54	–	53.11	5.03	1.85	–	0.94	57.83	53.37	65.87	21.47	21.69

NOTE: * indicates most recent data from 2005, all others' from 2006. Insufficient data available for Algeria, Egypt, Libya, Somalia, Syria, and Comoros. High income defined as above $11,116 per capita (2007 USD).

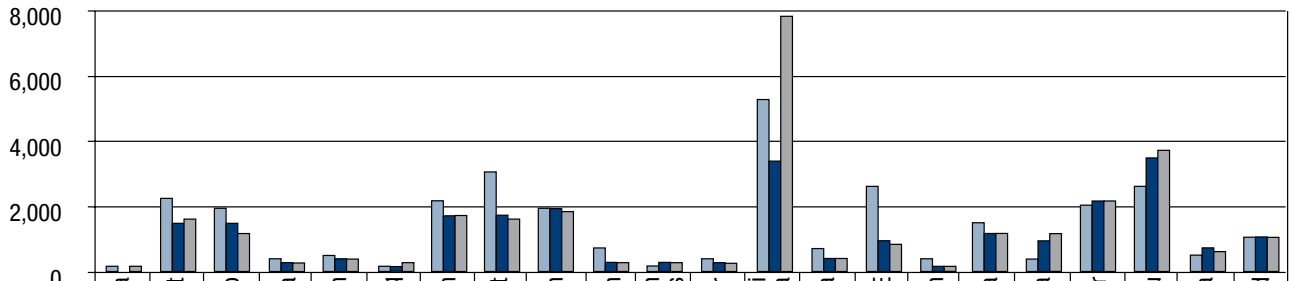
Source: UNESCO Institute for Statistics, 2008.

remains a challenge. Though there are improvements in "inputs," such as more children in school and more resources for education, the ultimate goal of human development is to "enhance the quality of people's lives and to enrich the capabilities of societies."[17] Thus, teacher training, education policies, curricula and pedagogical methodologies matter as well. The 2003 AHDR criticized the widespread focus on lectures and rote learning across the region. There is little evidence of significant change in these areas since 2003, though Jordan has made an ambitious national effort at change (see sidebar on page 20), Lebanon plans to introduce a new curriculum emphasizing science and technology, and Palestine is focusing more attention on assessment. Through an ambitious public partnership involving 8 multinational corporations, 3 international organizations, and 290 local companies, the Egyptian Education Initiative is working to enhance learning through expanded use of information and communication technology in the classroom, coupled with rigorous monitoring and evaluation. It is too early to assess the impact of these initiatives.

The six Gulf Cooperation Council (GCC) countries—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE—have one of the lowest student-teacher ratios in the world at 12:1. This ratio is also significantly lower than the other countries included in this study. However, international evidence indicates that low student-teacher ratios do not correlate to high student performance. The quality of teachers is far more important, as evidenced by Singapore, which has a student-teacher ratio of 24:1 in primary school but the highest scores in the world on international math and science exams.[18] Singapore also invests heavily in hiring the best teachers and training them well, up to 100 hours per year. Some GCC countries are taking steps to improve the quality of teaching. Bahrain plans to establish a special teacher training college. Abu Dhabi, the largest of the United Arab Emirates, is partnering with Singapore's leading teacher education institutions.[19]

One measure of the "output" of education is the performance of students on international tests. The 2003 AHDR cited results from the 1999 Trends in International Mathematics and Science Study (TIMSS), in which only Jordan, Morocco, and Tunisia participated. Though all three ranked below the international average in mathematics and science, the math scores of Tunisian

Figure 14 Number of Students in the United States, Select Arab Countries and Comparators



	Algeria	Egypt	Morocco	Tunisia	Bahrain	Iraq	Jordan	Kuwait	Lebanon	Oman	Palestinian Territories	Qatar	Saudi Arabia	Syria	UAE	Yemen	Tanzania	Mongolia	Ecuador	Peru	Slovakia	Ireland
2001	220	2,255	1,917	385	562	155	2,187	3,045	2,005	702	237	463	5,273	713	2,659	411	1,528	442	2,028	2,660	539	1,086
2005/06	132	1,509	1,502	277	373	190	1,733	1,703	1,950	337	309	254	3,448	446	978	246	1,239	927	2,173	3,519	697	1,100
2006/07	145	1,664	1,202	274	392	262	1,726	1,633	1,852	254	361	296	7,886	462	885	248	1,196	1,156	2,211	3,701	592	1,081

Source: Institute of International Education, "Open Doors Report" 2007.

[17] AHDR 2003, p. 52.
[18] Michael Barber, Mona Mourshed, and Fenton Whelan, "Improving education in the Gulf," *McKinsey Quarterly: Beyond Oil: Reappraising the Gulf States* (2007), p. 42.
[19] See Barber, et al, p. 44-45.

students mirror those of Israeli and Macedonian students, and Jordanian students outranked Iran and Chile in both math and science.[20] Moroccan students scored 38th out of 39 countries in both mathematics and science. Kuwait, which participated in the TIMSS study in 1995, did not participate again until 2007.

Commendably, Bahrain, Egypt, Lebanon, the Palestinian National Authority, and Saudi Arabia joined the TIMSS study four years later. The 2003 study shows significant progress in both math and science by Jordanian students. Indeed, Jordan exceeded the international average in science—a first ever achievement by an Arab country in this study. Moroccan students demonstrated improved scores in science. Regrettably, Tunisian scores actually declined significantly in both math and science and Moroccan scores declined significantly in math. Among the five newcomers to the study, all scored below the international average. Saudi Arabia showed the largest need for improvement, ranking 43rd out of 45 in mathematics, behind much poorer countries such as Botswana and the Philippines. Saudi Arabia's performance in science was better, ranking 39th out of 45. A new TIMSS study will be released in 2008. Algeria, Dubai (UAE), Kuwait, Oman, Qatar, Syria, and Yemen are all participating, showing a new willingness to evaluate educational achievement. The United Nations reports some favorable outcomes from this participation, including a new appreciation of the need for reform in Yemen and consideration of new teaching methods in Syria. Success depends on change in outcomes, not just intentions, but new interest in reform is a positive development.

Another measure of educational achievement is how well schools prepare citizens for productive employment. On this measure, education systems still lag. As a 2008 World Bank study demonstrates, links between education systems and employers remain weak in the Middle East and North Africa. Relative to other regions, educational institutions do not produce what markets need and markets do not absorb what educational institutions produce. Investments in education have improved economic growth less than would be expected due to the absence of opportunities for skilled and well-educated workers outside the public sector, and especially in high value-added manufacturing or service industries.

Improving quality is both pressing and challenging given the region's large youth population. Over the next thirty years, the World Bank projects that demand for secondary education will increase by one third and demand for tertiary education will more than double. [21]

Pay special attention to improving higher education: The 2003 AHDR observes that, although universities have existed in the Arab world for more than 1000 years, most modern institutions of higher learning were established only in the late 20th century. As these young institutions continue to establish themselves, they are joined by even younger institutions—one of the major developments in the Arab world since 2003. It is too early to assess the impact of these initiatives, but the investment is enormous.

As indicated in Table 3, Saudi Arabia alone has expanded vastly its higher education institutions in terms of the overall number and also in terms of enrolled students.

Table 3 Higher Education in Saudi Arabia

	2002	2006	% increase
Public universities	8	21	150
Public colleges	79	191	142
University hospitals	3	12	300
Private universities	1	4	300
Private colleges	4	17	325
Newly enrolled college students	67,855	110,103	62
Newly enrolled students in postsecondary education	136,723	214,572	57

Source: *Chronicle of Higher Education* (September 14, 2007), p. A32.

A major part of this initiative is the King Abdullah University of Science and Technology (KAUST). At a cost of $12.5 billion, King Abdullah is building a research university fifty miles outside of Jeddah, Saudi Arabia.[22] The university seeks to attract 20,000 faculty, staff,

[20] In the OECD's Programme for International Student Assessment, science scores in Tunisia were roughly constant between 2003 and 2006. Since Tunisia was the only Arab country to participate in 2003, longitudinal comparison is not possible for other Arab countries. However, Qatar and Jordan also participated in 2006. For 2006 scores in science, see www.pisa.oecd.org/document/2/0,3343,en_32252351_32236191_39718850_1_1_1_1,00.html.
[21] For an analysis of these points, see *The Road Not Traveled: Education Reform in the Middle East and North Africa*.
[22] Thanassis Cambanis, "Saudi king tries to grow modern ideas in desert," *The New York Times* (October 26, 2007).

FIGURE 15 Mathematics Scores of Eighth-grade Students, 2003

* Represents years of schooling counting from the first year of ISCED Level 1.

** Taken from United Nations Development Programme's *Human Development Report 2003*, p. 237-240.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

§ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.4).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

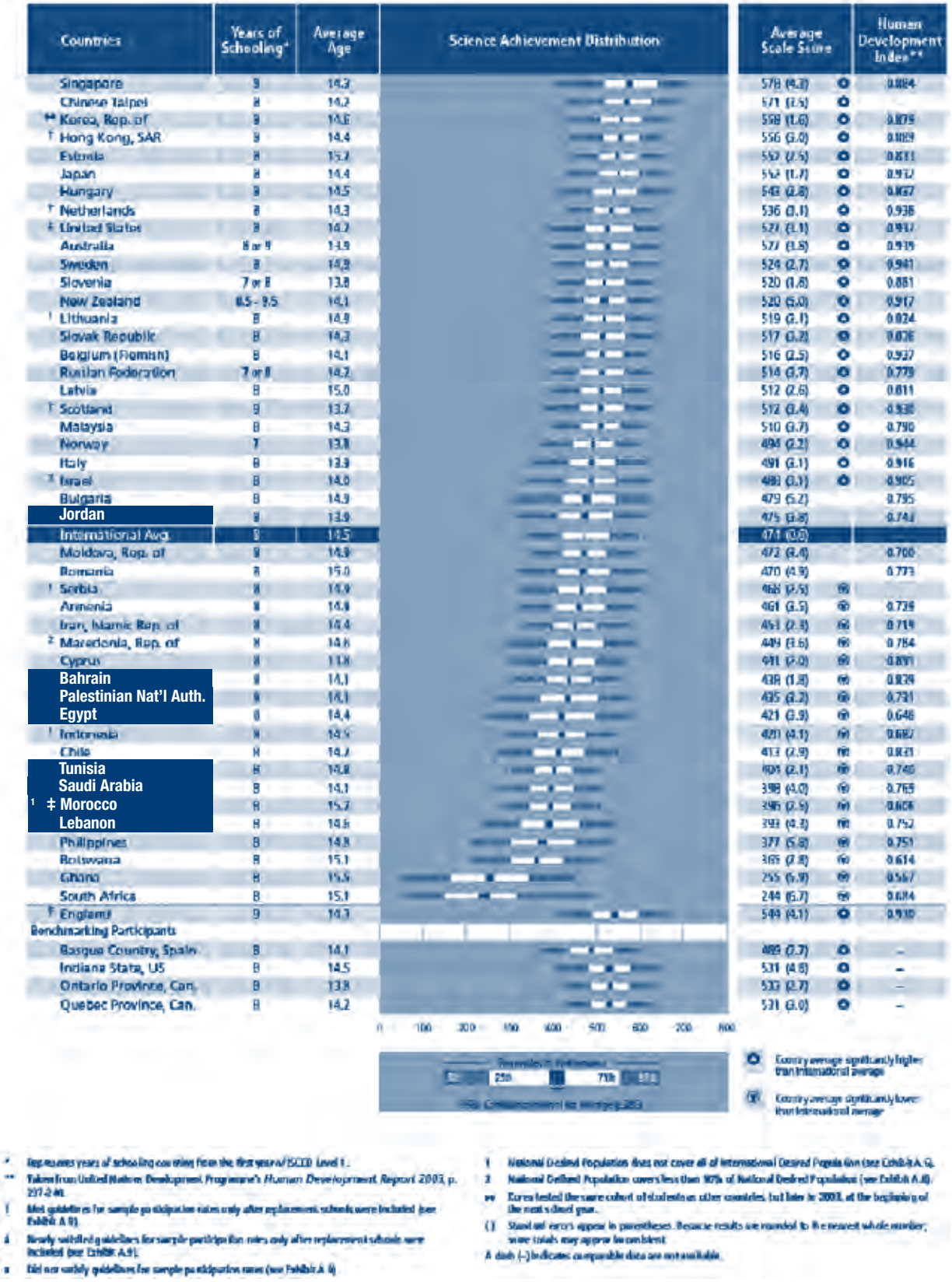
4 Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates comparable data are not available.

Source: Reproduced from International Association for the Evaluation of Education Trends, TIMSS 2003 International Report on Achievement in the Mathematics Cognitive Domains, p. 34.

Figure 16 Science Scores of Eighth-grade Students, 2003



Source: Reproduced from International Association for the Evaluation of Education Trends, TIMSS 2003 International Report on Achievement in the Sciences Cognitive Domains, p. 36.

students, and their families from around the world with generous salaries and scholarships. Initially it will focus on the biosciences, materials science and engineering, energy and the environment, and applied mathematics and computational science. Three leading universities—Stanford University, University of California at Berkeley, and University of Texas at Austin —signed agreements to help design the curriculum and hire faculty.[23] The university will be exempt from many of the kingdom's strict religious laws, allowing men and women to study and conduct research together. Officials claim that KAUST will permit a higher level of academic freedom and uncensored expression. A foreigner will serve as the university's first president.

KAUST represents an ambitious vision backed by substantial resources and political will. Yet, key questions remain. Will an academic enclave on a marshy peninsula of Saudi Arabia be able to attract world-class researchers and professors? Can a culture of openness and global collaboration thrive in a restrictive society? Can it retain top faculty and researchers over time and truly compete with other institutions worldwide? What will make this initiative succeed when other initiatives, such as the King Abdulaziz City for Science and Technology—the Saudi equivalent of the American National Science Foundation—have not lived up to expectations? Most importantly, even if the university succeeds as a global institution of higher learning, how much impact can it have on Saudi society when it is kept separate from that society?

Another noteworthy change since the 2003 AHDR is the creation of Education City, a campus of academic programs, research centers, and five Western universities with branch institutions in Doha, Qatar (see sidebar).

Education City, Qatar

The Qatar Foundation attracted five major American universities to open branches on a 2,500 acre campus outside Doha: Carnegie Mellon University, Georgetown University's School of Foreign Service, Virginia Commonwealth University, Weill Medical College of Cornell University, and Texas A&M. These programs will be supplemented by an $8 billion, 350-bed teaching hospital, a central library, and the Qatar Science and Technology Park. Education City, which reportedly cost $1 billion to build, attracts faculty with salaries between 25-40% higher than in the United States. Tuition for Qatari students is free.

A significant percentage of these students are women seeking to pursue higher education close to home. For instance, 75 of 120 students Carnegie Mellon students are female. At Georgetown's satellite campus, 68 of 107 students are female, and VCU's Qatar campus was only open to women until the class of 2007-2008, in which five men are enrolled.

Education City also includes an "Academic Bridge Program," now in its seventh year, which prepares students for study in world-class universities. Students learn substantive academic knowledge, English language skills, and also the "social awareness that will equip them for success in their chosen futures."

Enrollments	**Total**	**Qatari**	**Other Arab**
Cornell University (Weill Medical College)	204	37	134
Carnegie Mellon (business, computer science)	120	48	n/a
Georgetown University (School of Foreign Service)	107	48	29
Texas A&M University (engineering)	140	89	n/a
Virginia Commonwealth University (design)	197	114	46

Sources: School websites and email communications.

[23] Karin Fischer, "Despite doubts, 3 prominent universities sign deals with a Saudi university," *Chronicle of Higher Education* (March 14, 2008).

The 2003 AHDR underscored the need for quality in higher education, positing that no new universities should be created until they could meet elevated standards of quality. Efforts to build the new universities described earlier appear to reflect this commitment to quality, but questions remain about whether that commitment will endure. Moreover, these wealthy countries reflect only a small percentage of the region's universities and we see no major changes elsewhere since 2003. As of 2006, the top 20 universities in the Muslim world included only two Arab country universities: Cairo University and Kuwait University.[24] The 2003 AHDR identified poor facilities and a lack of autonomy from the political system as key obstacles to quality in institutions of higher education. In most Arab countries, that remains the case. A 2005 UNESCO science report echoed these concerns and also pointed to the lack of quality faculty members. Professors often received their undergraduate and graduate degrees from the same university where they are now employed, which narrows their exposure to other ideas and researchers.[25] There are bright spots. As of 2007, Cairo University ranked among the top 500 universities in the world, the only Arab university to achieve that distinction.[26]

Expanding access to higher education to less advantaged social groups—women, the poor, and minorities—was another recommendation of the report. Unfortunately, data in this area is inadequate to assess progress. Table 4 shows enrollment rates of the poor in Arab countries, but the data is significantly out of date. Gender parity has improved markedly. In the area of primary education, all Arab countries have achieved parity except Djibouti and Yemen and most have achieved parity at the secondary level. In higher education, the number of female students equals, and in many cases surpasses, the number of male students in all countries except Djibouti and Yemen.[27]

Creating an efficient system for life-long learning: The 2003 AHDR argued for an investment in life-long learning, with women as the highest priority. We see no empirical evidence of significant change since 2003. The region still features few opportunities to gain new skills and knowledge after completing formal degree programs. However, the explosion of information and communications technologies presents new and promising opportunities to create educational programming for adults and children alike (see pages 57-59 for a discussion of the information environment).

Table 4 Enrollment Rates for Poor and Nonpoor (%)

Country	Year	Age	Urban		Rural	
			Poor	Nonpoor	Poor	Nonpoor
Algeria	1995	primary	96.0	95.0	89.0	89.0
		secondary	77.0	82.0	59.0	66.0
Egypt	1995	6-15	89.5	98.0	98.9	95.6
		15-19	66.0	83.9	67.2	747
	1999	6-15	95.8	98.5	93.5	96.7
		15-19	72.4	84.9	64.7	72.9
Morocco	1990	7-15	70.7	84.1	34.3	43.2
	1998	7-15	69.4	87.2	36.4	49.8
Tunisia	2000	6-18	79.4	82.2	67.0	70.7
Yemen	1998	10-14	83.0	92.1	59.6	62.0

Source: *The Road Not Traveled: Education Reform in the Middle East and Africa*, p. 26. The World Bank, 2008.

[24] *Academic Rankings of Universities in the OIC Countries: A Preliminary Report* (Organization of the Islamic Conference, April 2007).
[25] Adnan Badran, "The Arab States," (UNESCO Science Report 2005), p. 174.
[26] See "Top 500 World Universities," (Institute of Higher Education, Shanghai Jiao Tong University, 2007).
[27] See *The Road Not Traveled: Education Reform in the Middle East and North Africa*, 2008, p. 28-31.

SCIENCE, TECHNOLOGY AND INNOVATION

Strategic Vision: Indigenizing science, universalizing research and development in societal activities, and keeping up with the information age

The overall portrait of science and technology in the Arab world is one of limited progress in a world of astonishingly rapid advances. Relative to other regions, Arab countries commit a smaller percentage of gross domestic product (GDP) to research and development; train fewer scientists and engineers; and produce fewer scientific publications, patents, and innovative technologies. Indeed, the Arab world as a whole does not stand out in any area except perhaps water desalination technology, an area of critical importance. Investment, even in an area of excellence *and* critical importance, is limited. The Middle East Desalination Research Center in Muscat, Oman, operates with a budget of just US$2 million per year.[28] R&D spending reflects this weak commitment, though there are promises by many Arab countries to increase R&D spending in the coming years.

Among Arab countries, there is significant variation in outputs (what is produced) and inputs (the investment of financial and human resources towards those ends).[29] In terms of inputs, oil producing states are investing new wealth in science, technology, and higher education. It is too early to measure the return on this investment. The other Arab states are considerably less well-off, facing opportunity costs similar to other developing countries. In terms of outputs such as patents and publications, Egypt—traditionally the Arab country with the strongest scientific base—is still well ahead of the rest of the region.

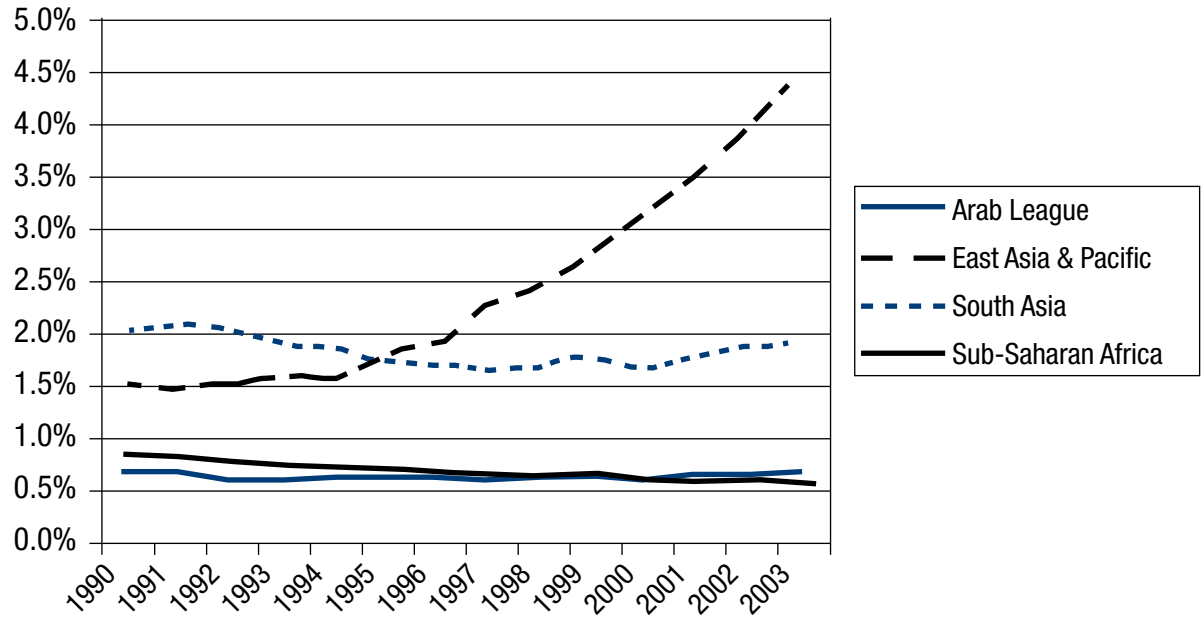
Measuring Knowledge Production

As indicated in Figure 17, the Arab world's production of scientific journal articles, as a percentage of the world total, has been largely flat for the last decade or more. Meanwhile, the share produced by East Asia and the Pacific has more than tripled.

Though the region did not fare well compared to other regions, Arab countries did increase scientific publications by 18% between 2000 and 2004. Egypt remained the research powerhouse of the Arab world, with double the publications of any other Arab country. Compared to four years earlier, Qatar, Yemen, the UAE, Algeria, and Tunisia increased their scientific publications the most.[30] Data from TWAS, the Academy of Sciences for the Developing World, show sustained gains for Egypt, Tunisia, Algeria, and Qatar in 2005 and 2006.[31]

[28] Cited in Jim Giles, "Oil Rich, Science Poor," *Nature,* Vol. 444 (November 2, 2006), p. 28. The article also noted that a 2002 article in *Nature* pointed to three areas of scientific research in which Arab world excelled: water desalination, camel reproduction and falconry research.
[29] The literature on S&T policy commonly distinguishes between outputs and inputs. See Smia Satti O. M. Nour, "Science and technology indicators in the Arab region: a comparative study of Gulf and Mediterranean Arab countries," (United Nations University –Institute for New Technologies, Discussion Paper #2005-3, August 2005).
[30] S.T.K. Naim and Atta-ur-Rahman, "Status of Scientific Research in OIC Member States," (COMSTECH, November 2005).
[31] TWAS, January 2007.

Figure 17 Share of World Scientific Journal Articles



Source: World Bank Development Indicators, 2007.

Table 5 Scientific Publications

Country	2000	2001	2002	2003	2004
Comoros	4	1	2	2	1
Djibouti	1	1	2	0	3
Somalia	1	0	2	0	4
Algeria	429	459	528	616	682
Egypt	2481	2785	2815	3288	2946
Libya	45	61	54	67	63
Morocco	1111	1168	1131	1131	972
Tunisia	636	708	793	995	994
Mauritania	16	16	13	20	14
Bahrain	75	71	70	87	98
Iraq	57	80	88	100	72
Jordan	625	640	670	800	749
Kuwait	550	584	544	622	607
Lebanon	549	619	494	626	617
Oman	250	259	277	301	295
Palestinian Authority	10	21	28	37	33
Qatar	54	64	60	87	126
Saudi Arabia	1614	1586	1610	1830	1583
Syria	122	116	121	145	153
United Arab Emirates	349	424	443	546	582
Yemen	29	54	40	35	52
Sudan	86	87	101	118	112
TOTAL	**9094**	**9804**	**9886**	**11453**	**10758**

Source: S.T.K. Naim and Atta-ur-Rahman, "Status of Scientific Research in OIC Member States", available at: www.comstech.org.

A 2005 UNESCO Science Report observed that the number of cited scientific papers per million inhabitants was 0.02 in Egypt, 0.07 in Saudi Arabia, 0.01 in Algeria, and 0.53 in Kuwait. Other Arab countries typically do not have any international cited publications. As a means of comparison, the United States publishes 43 cited scientific papers per million inhabitants, Switzerland publishes 80, Israel publishes 38, India publishes 0.04 and China publishes 0.03.[32]

Women in Science

Though women make up less than 30% of total researchers in Arab states, a small number of eminent women scientists are recognized globally. Of the 52 women honored with L'OREAL-UNESCO Awards for Women in Science from 1998-2008, four represent Arab countries: Egyptian physicist Karimat El-Sayed, Tunisian scientists Zohra ben Lakhdar and Habiba Bouhamed Chaabouni, and Emerati geneticist Lihadh Al-Gazali.

To assess the quality of scientific research, a frequently used measure is the number of times an article is cited by other researchers. Though a valuable indicator, the

[32] See Badran, p. 161.

data remain poor with the 2003 AHDR citing data from 1987. Nonetheless, one new data point suggests that there has been no major change from the situation presented in the 2003 AHDR: as of 2005, the world's top 5,000 most cited researchers included only one resident of an Arab country, Algerian immunology expert Boudjema Samraoui.[33]

The 2003 AHDR analyzed patents—another commonly cited indicator of S&T innovation—issued to nine Arab countries and compared them to patents issued to South Korea, Israel, and Chile. Table 6 shows positive change from 1995-1999 to 2000-2004. The nine Arab countries registered 27% more patents during that period. Though a noteworthy increase, these forward steps pale when compared to the great strides of other countries. Comparing the same two periods, South Korea registered more than twice as many patents, Israel registered 63% more, and Chile registered 48% more. China more than doubled its patents and is on track to do that again in the next five years.[34]

Table 6 Number of U.S. Patents Granted as Distributed by Year of Patent Grant

Country	1995-1999	2000-2004	2005-2006
Bahrain	1	1	0
Egypt	22	29	11
Jordan	11	6	1
Kuwait	22	33	10
Oman	2	0	1
Saudi Arabia	67	75	37
Syria	1	8	3
UAE	8	17	11
Yemen	0	1	0
Total	**134**	**170**	**74**
Chile	44	65	23
Republic of Korea	9984	19010	10260
Israel	3076	5014	2142

Source: United States Patent and Trademark Office, available at www.uspto.gov/go/taf/cst_utl.htm.

Investments in knowledge production

The 2003 AHDR identified four key "inputs" to knowledge production: the ability to produce knowledge workers, workers in scientific research and development, expenditure on research and development, and institutions.

> *"Getting a job is almost impossible because companies, especially international ones, ask for the highest skills. And we just don't have those."* [35]
>
> Kalid Zahrani, Saudi university student

Producing knowledge workers

As in 2003, research, anecdotal evidence, and interviews suggest that training and education is still not driven by the needs of employers, especially in the area of science and technology. Universities do not maintain close ties to business or adapt curricula to meet market demands. As a result, engineers and other employees with technical training often are not able to meet company standards, especially in multinational corporations that compete on a global level. To tap the rich human potential of the Arab region, companies such as Cisco Systems are developing in-region training programs to bring promising knowledge workers up to global standards.

Though producing knowledge workers remains a challenge, employing knowledge workers is more problematic still. Underemployment is high, especially for women. Women in Arab countries pursue higher education at roughly the same proportion as developed countries such as the United States. In science and engineering, the number of women enrolled in science and engineering majors often exceeds American counterparts.[36] However, few of these women go on to careers in science and engineering. To give just one example, "In Egypt, women represent more than one-third of the scientific community, and hold 35-50 per cent of postgraduate positions in Egyptian universities, but occupy just two per cent of high-level positions in science."[37]

[33] For a database searchable by country see www.isihighlycited.com.
[34] Note that patents registered locally are not reflected in this data. Innovations with only local application or developed by those unable or unwilling pay the high price of registering patents in the United States tend not to be registered with the U.S. Patent and Trademark Office.
[35] Quoted in Zvika Krieger, "Saudi Arabia puts its billions behind Western-style higher education," *Chronicle of Higher Education* (September 14, 2007), p. A1.
[36] Pervez Amirali Hoodbhoy, "Science and the Islamic World – the quest for rapprochement," *Physics Today* (August 2007).
[37] Wagdy Sawahel, "Arab network for women in science launched," SciDev.Net (February 25, 2005).

Underemployment is worst among people with higher levels of education. In Algeria, those with a post-secondary education represent approximately 20% of the labor force but 40% of the country's unemployed. In Egypt, those with a post-secondary education make up 42% of the labor force but 80% of the unemployed. And in Morocco, those with more than a secondary education make up 16% of the labor force but 30% of the unemployed.[38]

The 2003 AHDR analyzed the number of scientists and engineers working in research and development. Though we are able to report some new data in Table 7, much of the data is nearly a decade old so illustrating change is difficult. Other reports by UNESCO and the United Nations University also use data of this vintage. Data on the number of university students in science, technology, engineering and medicine is available, but also out of date. Table 8 shows the distribution of university students by field of study and a comparison to other countries. Some Arab countries enroll significant numbers in science, technical and engineering fields. For instance, over 30% of students in Jordan, Libya, and Tunisia pursue degrees in these fields. Enrollment in these fields is below 20% in Algeria, Egypt, Morocco, Oman, Qatar, Saudi Arabia, and the West Bank and Gaza.

Table 7 R&D, Select Arab Countries and Comparators

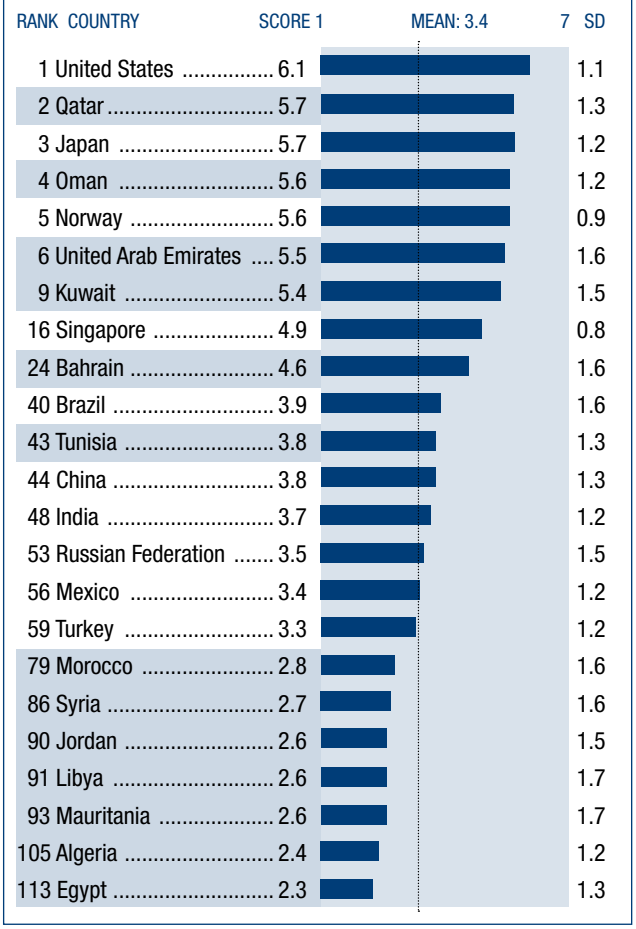
HDI Rank	Country	Year	R&D expenditures (% of GDP)	Researchers, Full-time Equivalents (per million people)
5	Ireland	2005	1.24%	2688
42	Slovakia	2005	0.52%	2022
86	Jordan	2002/2003	0.34%	2936
87	Peru	2004/1997	0.15%	226
91	Tunisia	2005	1.03%	1450
104	Algeria	2007	0.5%	170
112	Egypt	2000	0.19%	
126	Morocco	2003	.75%	*789

NOTE: *Figure for Morocco is in Head Counts instead of Full-Time Equivalents

Source: Human Development Index rankings from HDI 2007/2008, other data from UNESCO Institute for Statistics (UIS), 2008.

For many Arab countries, retaining skilled workers is perhaps the most pressing problem of all. Studies estimate that 500,000 intellectuals have emigrated from the Arab world. Doctors represent about half of this diaspora, while scientists represent another 15%.[40] A 2004 report by the Gulf Centre for Strategic Studies in Cairo indicated that each year 50% of newly trained physicians, 23% of engineers and 15% of scientists depart Arab countries for jobs in the West.[41] In Algeria alone, more than 40,000 researchers and specialists have emigrated abroad in recent years.[42] The problem is

Figure 18 World Economic Forum Executive Survey on "Brain Drain," 2006



Source: *The Arab World Competitiveness Report 2007*. Data collected at the World Economic Forum, Executive Opinion Survey, 2006.

[38] See *The Road Not Traveled: Education Reform in the Middle East and North Africa*, p. 212.
[39] Munir Nayfeh, "The Muslim diaspora – from brain drain to brain gain?" SciDev.Net (October 3, 2007).
[40] Cited in Herwig Schopper, p. 36.
[41] Khiati Mohamed, President of National Centre for Health Scientific Research in Algeria, quoted in Hichem Bourmedjout, "Algeria increases science spending," SciDev.net (December 21, 2007).
[42] Edward W. Lempinen, "Science diplomacy: Arab, U.S. women scientists build network at landmark Kuwait forum," *Science* Vol. 315, No. 5815 (February 23, 2007), p. 1090 – 1091.

Table 8 Distribution of University Students by Field of Study (%, most recent year)

Country	Year	Education and Humanities	Social Sciences	Medicine	Scientific, Technical, and Engineering	Others
Algeria	2003	16.4	38.2	7.1	18.0	20.2
Bahrain	2002	10.0	50.0	7.0	21.0	12.0
Djibouti	2003	20.0	51.0	0.0	22.0	7.0
Egypt, Arab Rep. of	1995	35.0	41.2	7.4	10.2	6.1
Iraq	2003	30.8	21.3	8.1	24.1	15.8
Jordan	2002	30.0	26.0	10.0	30.0	4.0
Lebanon	2003	21.2	38.8	8.5	25.7	5.8
Libya	1999	30.3	18.3	17.0	30.8	3.6
Morocco	2003	27.6	47.8	3.9	18.3	2.3
Oman	2003	54.2	21.1	2.8	14.0	7.9
Qatar	2003	19.1	48.3	3.9	19.1	9.5
Saudi Arabia	2003	60.7	15.1	4.6	13.6	6.1
Syria	1994	29.2	28.2	11.5	25.3	5.8
Tunisia	2002	22.0	27.0	7.0	31.0	13.0
United Arab Emirates	1996	57.8	13.6	1.7	24.1	2.8
West Bank and Gaza	2003	42.4	33.4	5.6	18.1	0.4
Mean		**30.8**	**32.2**	**6.7**	**22.6**	**7.7**
China	1994	22.8	9.4	8.9	46.8	12.1
Indonesia	1995	21.3	54.9	2.1	15.1	6.7
Korea, Rep. of	2002	23.4	20.4	7.3	41.1	7.9
Malaysia	2002	20.0	27.0	4.0	40.0	11.2
Philippine	2002	20.0	31.0	9.0	24.0	16.0
Thailand	1995	12.2	59.7	5.9	17.6	4.7
Mean		**19.9**	**33.7**	**6.2**	**30.8**	**9.8**
Argentina	2002	10.0	35.0	10.0	14.0	31.0
Bolivia	2000	26.0	33.0	17.0	16.0	8.0
Brazil	1994	20.5	44.0	9.3	20.1	6.1
Chile	2002	20.0	35.0	9.0	32.0	5.0
Colombia	1996	17.1	43.2	9.1	28.5	2.2
Mexico	2002	15.0	42.0	8.0	32.0	4.3
Peru	1991	13.0	42.1	11.4	24.3	9.2
Mean		**17.4**	**39.2**	**10.5**	**23.8**	**9.4**

Source: *The Road Not Traveled: Education Reform in the Middle East and Africa*, p. 21. The World Bank, 2008.

particularly stark in Iraq where an estimated 40% of professionals have emigrated since 2003.[43] Migration of talented workers out of the region was a concern in 2003 and remains so today. However, there is new reason for hope: other developing countries such as China are attracting their knowledge workers home like never before. Turning brain drain into "brain circulation"—in which talented individuals go abroad to study and work but then return home with new knowledge—is possible.

> *"Women scientists in Yemen are very much underestimated, maybe because we come from a country that really doesn't believe in woman in any field, especially in science. We have very distinguished scientists and very active girls who would like to be distinguished in science, but they don't have that chance, or they don't get that chance.... We would like, after we come home, to be more distinguished in our country and be more active and achieve all our expectations in the field of science."* [42]
>
> —Fatima Ahmed Alhadi, assistant professor of plant physiology at University of Sanaa

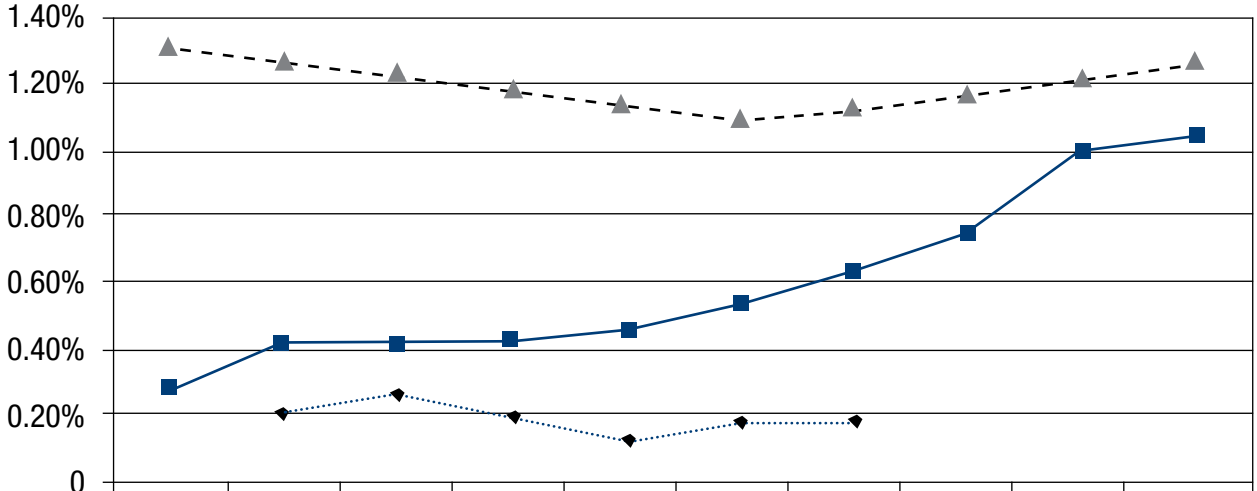
Despite prevalent brain drain, there is some good news to report. In a 2006 World Economic Forum opinion survey, executives in Qatar, Oman, the UAE, and Kuwait scored well when asked whether talented people typically stayed in the country. Indeed, Qatar ranked closely behind the United States and ahead of Japan. The other three ranked ahead of Singapore.

Spending on Research and Development

The 2003 AHDR reported a lack of political will to spend resources on research and development. A 2005 UNESCO Science Report indicates that by 2000, Arab states devoted an average of 0.02% of the spending on R&D, compared to 0.06% for African states, 3.6% in India, 1.4% in Brazil, 0.03% in Argentina and South Africa.[44]

Since these reports, several Arab countries are showing renewed interest in science and technology. Algeria approved a US$1.5 billion budget increase for scientific research and technological development, raising the country's expenditure to 1% of GDP. According to Algerian government officials, the country plans to in-

Figure 19 R&D Expenditure (% of GDP)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Kuwait		0.21%	0.26%	0.20%	0.13%	0.18%	0.18%			
Tunisia	0.30%	0.43%	0.43%	0.44%	0.46%	0.53%	0.63%	0.73%	1.00%	1.03%
Ireland	1.30%	1.27%	1.23%	1.18%	1.13%	1.10%	1.10%	1.16%	1.20%	1.24%

Source: UNESCO Institute for Statistics, 2008.

[43] Estimate provided by Michael O'Hanlon and Jason Campbell, who compile the Iraq Index for the Brookings Institution (www.brookings.edu/saban/iraq-index.aspx).
[44] Badran, p. 162.

crease the budget to 1.5% of GDP by 2011.[45] The UAE unveiled a three-year strategic plan for higher education and scientific research in the summer of 2007 and is establishing a national research foundation to award funding through peer-reviewed competition. Saudi Arabia approved a new science and technology plan in 2002, with a commitment to spend 1.6% of GDP on R&D by 2020. Emir Hamad bin Khalifa Al-Thani of Qatar has created an endowment that generates millions of dollars to support research every year and is laying the groundwork for a major new research organization. In Egypt, the Cabinet approved a plan to overhaul how the country funds scientific research and increase the level of funding, up to ten times the current rate, according to Prime Minister Ahmed Nazif. Egypt now spends only 0.02% of its GDP on science and technology, low even compared to the average of 1% allocated by other developing countries.[46] A new funding agency will award competitive grants to fund scientific research; in the past, critics claimed, biased grant-making and bureaucracy absorbed most of the funds.[47] The country is also creating a new S&T council, composed of Cabinet members, scientists, and business representatives.

Outside of national governments, the new Mohammed bin Rashid Al Maktoum Foundation will invest its $10 billion endowment in human development, which includes scientific research. The Jeddah-based Islamic Development Bank invests in science and technology projects. Funding from international donors supports scientific research as well. For instance, the Nanotechnology Research Laboratory at Al-Quds University in East Jerusalem—which raised $1 million from the German Research Foundation and French Academy of Sciences—is perhaps the first such lab in the Arab Middle East.[48]

Mirroring this interest, the Organization of the Islamic Conference, an international organization with 57 member countries including the Arab states, committed in December 2005 to a ten-year plan to promote science and technology in the Muslim world. The OIC set a goal of

The Mohammed bin Rashid Al Maktoum Foundation

In May 2007, Sheikh Mohammed bin Rashid Al Maktoum, the ruler of Dubai and the Prime Minister of the United Arab Emirates, announced the creation of the Mohammed bin Rashid Al Maktoum Foundation to help build "a knowledge-based society" in the region. With an initial endowment of $10 billion from Sheikh Mohammed, the foundation will "invest in knowledge and human development, focusing specifically on research, education and promoting equal opportunities for the personal growth and success of our youth." The foundation also intends to focus on employment and entrepreneurship to cope with high levels of unemployment in the region, among the highest in the world.

One of the foundation's initiatives will be an annual Arab Knowledge Report issued in conjunction with the United Nations Development Program. Other early initiatives include a scholarship program to support Arab students who have already been accepted to graduate programs in business administration and public policy overseas and a grants program to support Arab authors to write and publish books in Arabic. Scholarship programs to help students to study in the region are also planned. According to the foundation, these programs will support people and initiatives from across the Arab world. Future projects will include teacher training programs, online education for women, preparing universities to graduate students ready for careers, and translation initiatives.

Though the foundation has a compelling and ambitious vision, it is too early to assess its impact. The first grants will be awarded in 2008.

[45] Hichem Bournedjout, "Algeria increases science spending," SciDev.Net (December 21, 2007).
[46] Robert Koenig,"Egypt plans a shakeup of research programs," *Science* (July 6, 2007), p. 30.
[47] "Egyptian science faces reform," SciDev.Net (July 6, 2007).
[48] Jason Pontin, "In tiny particles, a big link in Jerusalem," *The New York Times* (September 23, 2007).

Arab Science and Technology Foundation

Founded in 2000, the Arab Science and Technology Foundation (ASTF) is an independent, non-profit organization that promotes science and scientific research across the Arab region. To accomplish this objective, ASTF builds cooperation between scientists in the Arab world and to scientists worldwide—especially those of Arab decent. In addition to funding scientific research projects, the foundation promotes the application of science to address market needs, women in science, attracting young people to science, and the need for scientific networks.

To achieve these goals, ASTF continues to host numerous conferences including a conference of Arab women in science and technology to be held in 2008. ASTF will also create an association for Arab women in research and development and continue to support start-up companies.

ASTF awarded 84 grants to support scientific research between its founding in 2000 and December 2006, benefitting 504 researchers in 14 Arab countries. Awards are competitive; ASTF received 828 applications for those grants. In the same period, ASTF provided funds to 22 start-ups related to science and technology.

The foundation also serves as a partner for organizations and companies that wish to support science and technology in the Arab world. For instance, ASTF co-sponsored the "Second Arab Technology Business Plan Competition" with Intel. $100,000 in prize money was awarded to the winning innovators. ASTF also advocates for science, technology, and engineering in the Arab Middle East in a region with few civil society organizations.

spending 1.2% of GDP on research and development, in order to break with a history of "stagnation."[49] However, 20 months after setting that goal, the members remained focused on "preparatory planning and coordination," inviting calls to move forward more quickly.[50]

Private funding for scientific research, education, and knowledge development also contributes to building an Arab knowledge society. Though it is increasing, such funding is low compared to other regions where private companies' spending on research and development far outstrips public expenditures.[51] Among Arab countries, 20% of Kuwaiti R&D spending, 12% of Moroccan R&D spending, and 14.5% of Tunisian R&D spending (an increase from 5.7% in 2000) comes from private companies. In comparison, 37% of Slovakian R&D spending and 40% of Brazilian R&D spending comes from the private sector.[52]

With all these initiatives, the question remains: will they lead to significant and sustainable change over time? Earlier pronouncements have produced concrete results all too infrequently.[53]

Institutions

"The history of scientific development shows that science cannot be developed without institutions dedicated to this purpose and without promoting the vocation of scientists and scientific applications," according to the 2003 AHDR.[54] Here we note positive change. The number of higher education institutions has increased, as shown earlier. New, free-standing centers of research are growing in number thanks to funding from oil-rich Gulf countries. Yet, many other institutions remain underfunded and characterized by slow progress. There are bright spots. One venture, noted in the 2003 AHDR, is the Arab Science and Technology Foundation, an independent non-governmental organization (see sidebar). This organization displays an impressive range of activities in the spirit of the 2003 AHDR. However, like many non-governmental organizations worldwide,

[49] Wagdy Sawahel, "Islamic states urged to follow 10-year science plan," SciDev.Net (December 14, 2005).
[50] Wagdy Sawahel, "Islamic countries 'dragging their feet' on science plan," SciDev.Net (September 11, 2007).
[51] For a discussion, see "Of Internet cafes and power cuts," *The Economist* (February 9, 2008), p. 75-77.
[52] UNESCO Institute for Statistics, 2008.
[53] For examples, see Schopper, *Nature* (November 2006), p. 36.
[54] AHDR 2003, p. 69.

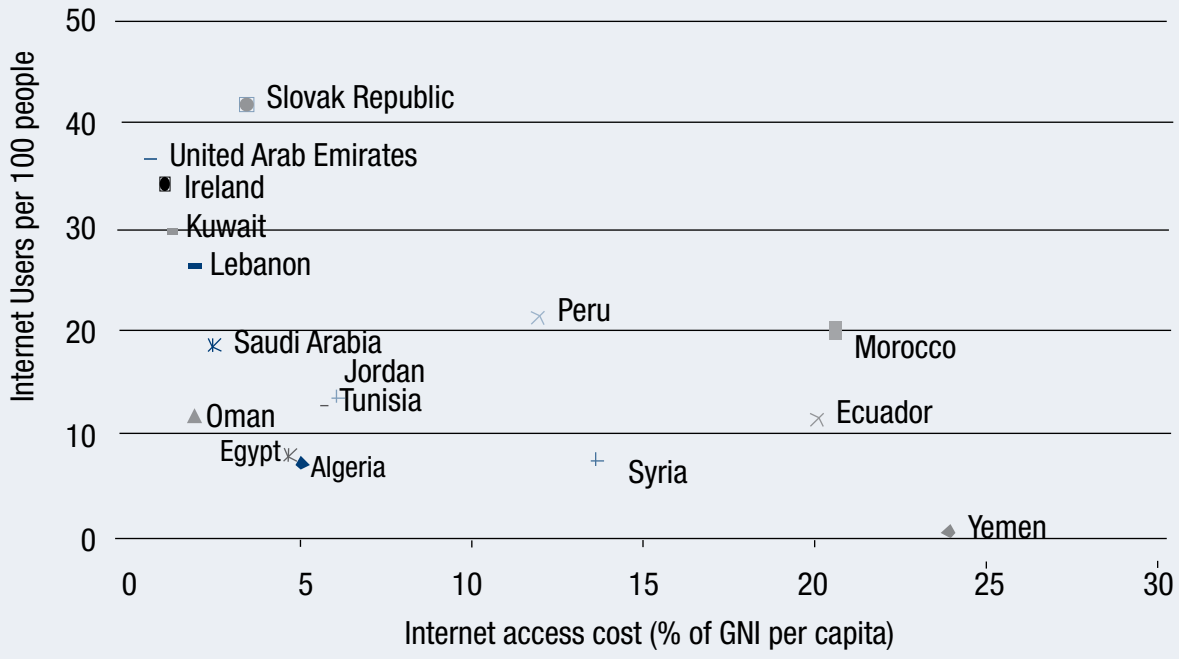
the organization operates on tenuous soft money rather than a core endowment. The Amman-based Islamic World Academy of Sciences, formed in 1986, advises governments on S&T policy and supports a range of activities, but operates on a very small budget of voluntary contributions. The Beirut-based Arab Academy of Sciences is a scientific non-governmental organization supported by UNESCO and launched in 2002. The Academy brings together scientists to advance their research in fields such as biotechnology, nanoscience, bioethics, water management, and the role of science parks.

Social networks are also critical to cultivating a knowledge society. Modern scientific research advances largely through collaboration and engagement in scientific networks. The 2003 AHDR noted that Arab researchers had not yet established a single dynamic Arab network or scientific group, leaving Arab scientists to work in isolation or—in some circumstances—with distant colleagues. Though this is still the case, there has been some small progress.

In addition to the organizations referenced above, in 2005 UNESCO formed the Arab Network for Women in Science and Technology to foster "participation of women, especially young ones, in the field of science and technology and enhanced visibility of Arab women scientists in scientific societies and professional meetings. The Network also will contribute towards strengthening collaboration and improved communication among women scientists in the Arab region, on one hand, and their peers around the world, on the other."[55] The Kuwait Foundation for the Advancement of Science has also invested in creating networks of women scientists and engineers in the region, hosting a major region-wide conference in January 2007.

Another effort to build networks between knowledge workers in the Arab diaspora and their home countries is the United Nations program TOKTEN, or Transfer of Knowledge Through Expatriate Nationals. Referenced in the 2003 AHDR, the program allows expatriates to return home for periods ranging from two weeks

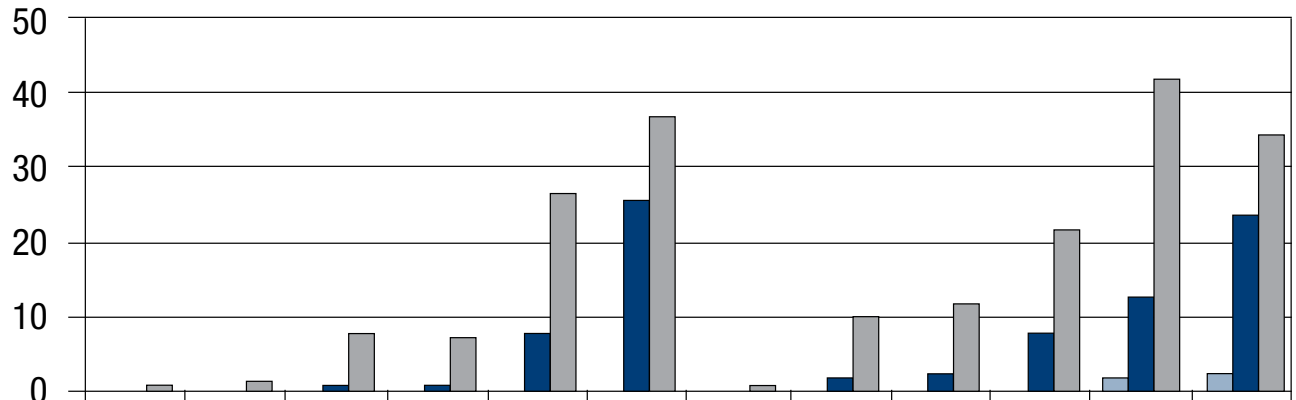
Figure 20 Correlation Between Internet Penetration and Internet Costs



Source: ITU World Telecommunication ICT Indicators 2007.

[55] "An aide memoire on the establishment of an Arab Network for Women in Science and Technology (ANSWT)," (UNESCO: November 2004), available at www.unesco.org/science/psd/gender/ar_netw.shtml (accessed April 21, 2008).

Figure 21 Internet Users Per 100 Inhabitants, Select Arab Countries and Comparators



	Somalia	Yemen	Egypt	Algeria	Lebanon	UAE	Tanzania	Mongolia	Ecuador	Peru	Slovak Republic	Ireland
1996	0.002	0.001	0.067	0.002	0.162	0.388	0.002	0.018	0.085	0.251	0.781	2.206
2001	0.083	0.090	0.930	0.648	7.761	25.712	0.169	1.666	2.585	7.665	12.531	23.314
2006	1.106	1.248	7.954	7.375	26.283	36.685	1.003	10.136	11.544	21.494	41.764	34.134

NOTE: Tanzania and Mongolia's data from 2005.

Source: ITU World Telecommunication ICT Indicators 2007.

to three months in order to contribute to their homeland's development. Currently, TOKTEN programs are in place in Jordan, Lebanon, the Palestinian Territories, and Sudan.[56]

As always, a key question is whether these networks will endure and be effective, especially when earlier efforts to engage scientists, engineers, and researchers have failed.

Keeping abreast of the Information Age

The 2003 AHDR called for the Arab world to join the ICT revolution "much more decisively." Though further progress is still necessary, especially in terms of making broadband Internet access less expensive and more widely available, this is an area of great accomplishment. One of the most significant changes since the 2003 report is the enormous growth in access to information and communications technologies. Arabic language websites are growing rapidly, with more than 10,000 registered in Morocco alone as of 2006.[57] Unsurprisingly, as indicated by Figure 20, there is a direct correlation between cost and the number of Internet users.

> *"One of the largest obstacles to conducting scientific research is the high cost of broadband access. At the Bibliotecha Alexandrina, we spend ten times what we would spend at a comparable research institution in the United States."*
>
> —Ismail Serageldin, Director of the Bibliotecha Alexandrina

Overall, the number of internet users has grown sharply. In 2006, the UAE led the region with 36.7 internet users per 100 inhabitants, up from 25.7 in 2001. Lebanon followed with 26.3, up from 7.8 in 2001. Egypt followed with 8 users per 100 inhabitants, a significant increase from 0.9 in 2001. Even in this area of progress,

[56] See "TOKTEN channels global expertise back home," (UNDP: April 28, 2008), available at www.unv.org/en/what-we-do/countries/viet-nam/doc/tokten-channels-global-expertise.html (accessed April 21, 2008).
[57] See Heydemann, p. 18.

however, other countries and regions are moving faster. Peru's internet penetration jumped from 7.6 to 21.5 and the Slovak Republic jumped from 12.5 to 41.8 in the same period.

Mobile telephone use, which facilitates inexpensive and frequent communication, surged between 2001 and 2006. Subscribers doubled in the UAE over this five year period. In Algeria, subscribers jumped from 0.3 subscribers per 100 inhabitants to 63 subscribers per hundred inhabitants. The wide use of mobile telephones also facilitates the use of "text messaging" (also known as SMS or short message service), a convenient and cost-effective email-like service. The explosion in use of mobile phones and text messaging demonstrates how rapidly average Arab citizens will adopt new technologies if they are useful and attractively priced.

The region is registering sharp gains in global rankings of information and communication technology capacities (ICT), according to The World Economic Forum. In global rankings of network readiness—which assess the business and regulatory environment for ICT, ICT infrastructure, people's ability to use ICTs, and actual usage rates—Egypt rose 17 places to 63rd in the world and Morocco rose 5 places to 74th. Other Arab countries also rose, with Qatar rising 4 places to 32nd in the world, Bahrain rising 6 places to 45th, and Jordan rising 11 places to become 47th in the world.[58]

TABLE 9 Internet Costs and Penetration, Arab Countries and Comparators

Country	Internet Tariffs as % of GNI per Capita (March 2006)	Internet Users per 100 (2006)
Algeria	5.0	7.4
Bahrain	2.5	-
Comoros	81.3	2.6
Djibouti	51.9	1.4
Ecuador	20.1	11.5
Egypt	4.8	8.0
Iraq	-	-
Ireland	1.1	34.1
Jordan	6.1	13.7
Kuwait	1.2	29.5
Lebanon	2.0	26.3
Libya	6.0	-
Mauritania	122.8	3.2
Mongolia	21.4	-
Morocco	20.5	19.8
Oman	1.9	12.2
Palestinian Authority	16.7	-
Peru	12.0	21.5
Qatar	-	34.5
Saudi Arabia	2.5	18.7
Slovak Republic	3.5	41.8
Somalia	-	1.1
Syria	13.6	7.7
Tanzania	351.0	-
Tunisia	5.6	12.7
United Arab Emirates	0.7	36.7
Yemen	23.9	1.2

NOTE: Tariffs are the sum of the connection fee, monthly service fee, and twenty hours of use.

Source: ITU World Telecommunication ICT Indicators 2007

[58] Soumitra Dutta and Irene Mia, "Executive Summary," *Global Information Technology Report 2007-2008* (World Economic Forum, 2008).

KNOWLEDGE-BASED INDUSTRY

Strategic Vision: Shifting rapidly towards knowledge-based production

For too long, the 2003 AHDR argues, Arab economies depended on the extraction of natural resources and the importation of science and technology. For the rewards of today's global economy to extend throughout societies, benefiting all their members, economic growth must come from dynamic, innovative economies built more on human capital than natural resources. Such pursuits pay greater dividends to larger numbers and reward productive work.

> *"Buoyed by high oil prices and intensifying global trade linkages, the Arab world is enjoying spectacular rates of growth for the fourth year in a row . . . but the region is still far from realizing its full growth potential. . . . Many countries show a respectable track record for improving competitiveness in relation to their own past; however, when benchmarked against peers in other parts of the world, many Arab economies—particularly the oil-exporting ones—fall behind."*[59]
>
> —Arab World Competitiveness Report 2007

Industries based on knowledge create ongoing incentives for knowledge production. Since knowledge adds value to products and services, such industries create a reliable and increasing demand for even more knowledge. This demand strengthens societal institutions that produce knowledge and attracts knowledge workers and institutions.

Progress in building knowledge-based industries varies significantly across Arab countries, with the UAE accelerating and others inching forward. As with other areas, the question is whether this incremental progress is sufficient. As CEOs of major multinational companies suggest, organizations must now innovate faster just to maintain their position—let alone outpace their competitors.[60]

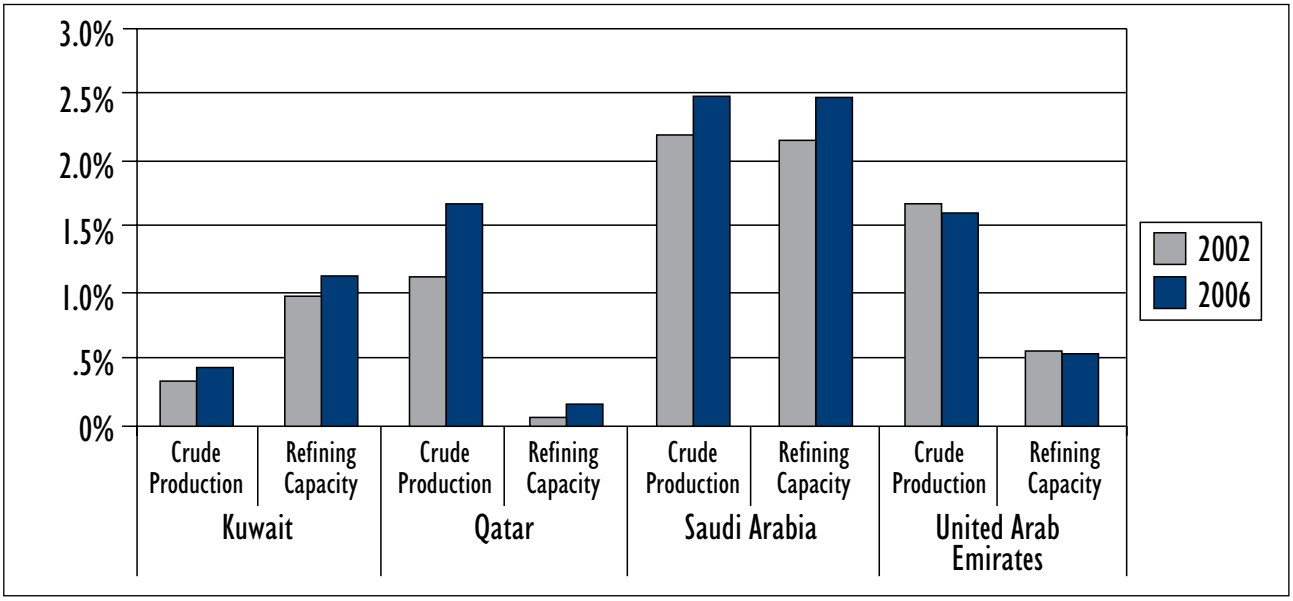
The 2003 report recommended two specific steps towards greater knowledge-based production:

1) *Moving quickly to the upstream or downstream ends of processing in oil and natural gas industry which require higher skills, more value added activities*

The 2003 AHDR focused on energy as the key area for investment. Current analyses support this approach, but identify additional innovative sectors that are now ripe for investment.[61] These include information and communication technologies, mining and utilities, and engineering, construction, and real estate.[62] Within the energy sector, the 2003 AHDR focused on oil and gas. Since then,

[59] Margareta Drzeniek Hanouz, Sherif El Diwanny, and Tarif Yousef (eds.) *The Arab World Competitiveness Report 2007: Sustaining the Growth Momentum* (World Economic Forum), p. vii.
[60] "Revving up: how globalization and information technology are spurring faster innovation," *The Economist* (October 13, 2007), Special report on innovation, p. 8.
[61] Soumitra Dutta, Zeinab Karake Shalihoub, and Geoffrey Samuels, "Promoting Technology and Innovation: Recommendations to Improve Arab ICT Competitiveness," *The Arab World Competitiveness Report 2007* (World Economic Forum), p. 86.
[62] Jean-Eric Aubert, *Building Knowledge Economies: Advanced Strategies for Development* (World Bank Institute Knowledge for Development Program, 2007).

Figure 22 Crude Oil Production and Refining Capacity (both as percentage of world total)



Source: OPEC Annual Statistical Bulletin 2006.

renewable energies have emerged as a promising area for further investment. Abu Dhabi, for instance, launched the Masdar Initiative in 2006 to support research, education, and business opportunities in the field of renewable energy. A 100-megawatt solar power plant is also planned.[63] Encouraging investment in all these sectors contributes to other goals laid out in the 2003 AHDR, such as the diversification of economies and innovation.

Overall, high-technology exports from the region are rising fast. Between 2000 and 2005, high-technology exports jumped 77.8% in Jordan, 31% in Morocco, and 161% in Saudi Arabia. These increases are significant and laudable—but, as Figure 22 shows, they are outstripped by other fast-growing countries such as the Slovak Republic.

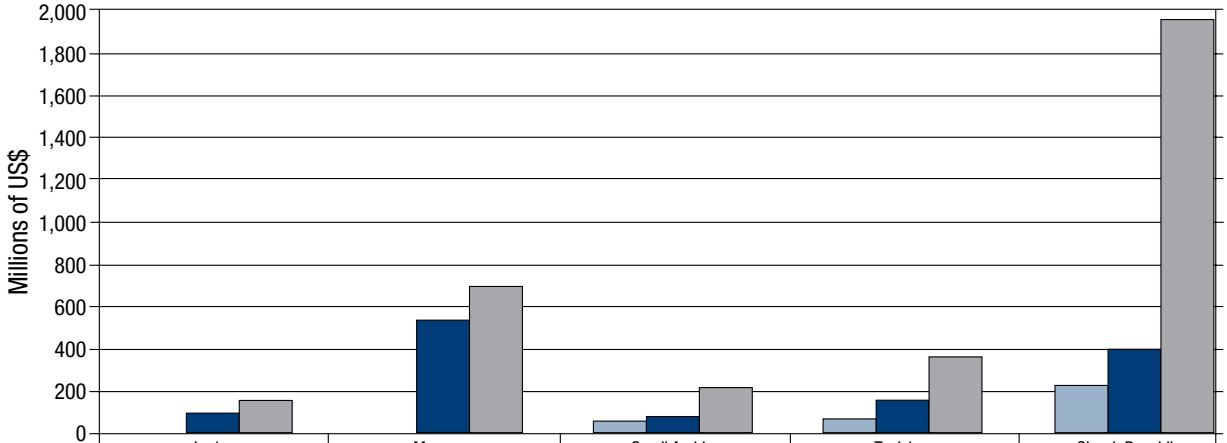
2) Investing state resources in diversifying economic structures and markets and developing renewable resources through knowledge and technological capabilities.

Economies in the region are diversifying beyond their traditional focus on commodities and energy. The UAE has been a leader, with the creation of Dubai Media City and Dubai Internet City (see text box on page 48). Qatar is investing heavily as well, in laboratories and research centers as well as higher education. With their oil-rich coffers, these countries are exceptional in the region—but they do show the rewards of investments in knowledge. Egypt and Jordan both feature rapidly growing telecommunications and software industries, with Egypt now home to the fastest growing ICT market in the world. This market includes 1,530 foreign and Egyptian ICT companies, which provide over 40,000 jobs.[64] The Egyptian firm Orascom Telecom alone has 65 million mobile subscribers.[65]

Despite selective progress, much more investment is needed across the region. To build a knowledge society, state investment in the information and communication technology sector must be a priority. Though this is an area of tremendous growth, Table 10 demonstrates that

[63] Andrew England, "Abu Dhabi eyes renewable energy future," *The Financial Times* (April 4, 2007).
[64] "Egypt is open for business," *Korea Times* (July 22, 2007).
[65] Cassell Bryan-Low and Mariam Fam, "Egypt's Sawiris family expands its reach; sale to Lafarge offers entree to France as three brothers continue to try new markets," *The Wall Street Journal* (December 12, 2007), p. B1.

FIGURE 23 High-Technology Exports (Millions of US$)

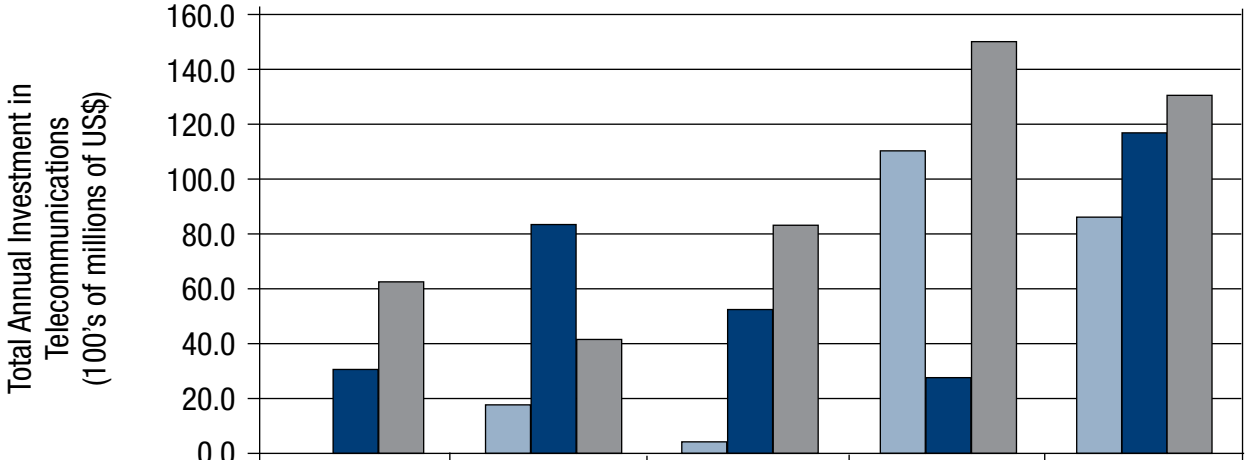


	Jordan	Morocco	Saudi Arabia	Tunisia	Slovak Republic
1996/1997	3.2	8.3	56.8	72.0	229.0
2000	90.0	536.9	82.4	154.1	405.3
2004/2005	160.1	701.8	215.1	370.2	1959.6

NOTE: High-technology exports are products with high R&D intensity, such as aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

Source: World Bank Development Indicators, 2007.

FIGURE 24 Investment in Telecommunications



	Egypt	Morocco	Saudi Arabia*	Mongolia	Slovak Republic
1995*/1996	0.0	17.2	3.7	110.3	85.8
2001	30.1	83.0	52.3	27.2	116.8
2005/2006*	61.9	41.1	83.0	150.0	130.4

NOTE: Data for Saudi Arabia from 1995 and 2006; all others from 1996 and 2005.

Source: ITU World Telecommunication ICT Indicators 2007.

Table 10 Ranking of ESCWA Members According to Maturity Level in E-Business and E-Commerce

Country or Territory	Maturity Level 1		Maturity Level 2		Maturity Level 3		Maturity Level 4	
	2003	2005	2003	2005	2003	2005	2003	2005
Bahrain			x					x
Egypt			x	x				
Iraq	x	x						
Jordan			x			x		
Kuwait					x	x		
Lebanon			x			x		
Oman					x	x		
Palestine	x	x						
Qatar						x		
Saudi Arabia					x	x		
Syria		x	x					
United Arab Emirates					x			x
Yemen	x	x						

NOTE: ESCWA determines maturity level with qualitative measures of how e-business and e-commerce function in each country. The different levels indicate the country's effort, plans, implementation, and benefits derived from e-business and e-commerce.

Source: Economic and Social Commission for Western Asia (ESCWA). "Regional Profile of the Information Society in Western Asia," United Nations, 2005, p. 58.

the region still has much work ahead to close the gap with developed countries. Given that most developed countries would receive a perfect or near perfect scores on these measures, even the wealthiest Arab states show room for improvement.[66]

Oil-producing countries in the region feature the least diversified economies, relying heavily on oil exports to drive economic growth. Fuel represents more than 80% of merchandise exports in Algeria, Oman, Qatar, Saudi Arabia, Yemen and Sudan.[67] As a result of this dependence on oil, the region as a whole exports fewer non-oil products and services than Finland or Hungary, countries with a combined population of 15 million.[68]

Dubai's Innovation Experiment

Since 2000, the United Arab Emirates has experimented with state-launched innovation initiatives: Dubai Media City, Dubai Internet City and Knowledge Village. These initiatives create clusters of companies, business incubators, and venture capitalists in an effort to spur collaboration, innovation, and growth.

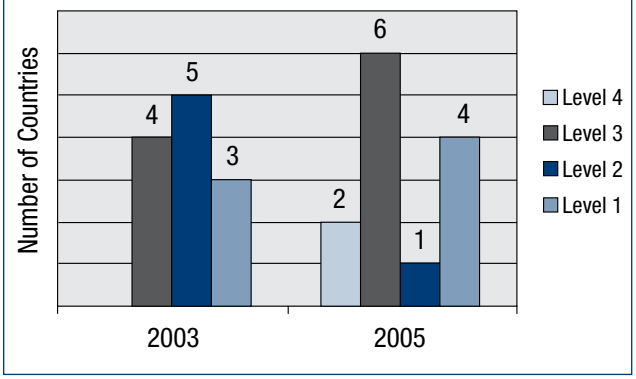
This investment is showing returns. Dubai Media City now houses 550 media companies, including both local and multinational firms. Dubai Internet City counts hundreds of high-tech companies among its members. All together, this innovation center employs more than 7,000 knowledge workers.[69]

[66] United Nations Economic and Social Commission for Western Asia, "Regional Profile of the Information Society in Western Asia," (New York: United Nations 2005), p. 68.
[67] World Bank Development Indicators, 2007.
[68] *The Road Not Traveled: Education Reform in the Middle East and North Africa* (Washington DC: World Bank, 2008), p. 234.
[69] See Dutta et al, p. 89.

The 2003 AHDR focused on the investment of state resources. However, the region's growth over the last five years has also come from strong inflows of foreign capital as well as domestic private credit, according to the International Monetary Fund.[70] This is a positive change. According to the World Bank Institute, R&D funds come increasingly from business—as much as 50%—as economies develop.[71] Business investment in R&D fuels growth and leaves state resources for other priorities.

A major change since the 2003 AHDR is the expansion of private financial markets in the region. Trading volume on the Dubai Financial Market (DFM), for instance, totaled $200 million per day in January 2007; 10 months later trading reached $1 billion per day.[72] New venture capital funds in Oman worth US$135 million will fund investment in S&T based businesses in the Gulf region, especially Oman, over the next ten years. A $15 million fund, launched by ASTF, will also provide venture capital for new companies.[73] Capital for innovative high-risk ventures is still less available than in other regions, but raising investment capital has grown easier. Gulf financial markets rose in value from $360 billion to $1.2 trillion between 2001 and 2006.[74] Islamic banking and finance are expanding and diversifying sources of capital throughout the region.[75]

Figure 25 Maturity Levels of ESCWA Members in E-commerce and E-business



Source: Economic and Social Commission for Western Asia (ESCWA). "Regional Profile of the Information Society in Western Asia," United Nations, 2005, p. 58.

Economic Change Since 2003

Economic growth fertilizes a knowledge society, according to the 2003 AHDR. Since that report, economies expanded throughout most of the Arab world as illustrated in Figure 26. Between 2000 and 2005, per capita GDP increased most significantly among the oil-producing states. However, per capita income grew by 19.7% in Jordan, 18.6% in Tunisia, 14.6% in Lebanon, and 9.4% in Egypt. In absolute terms, this growth is impressive. However, it is still outstripped by explosive growth in East Asia and the Pacific—and by the global average for low and middle income countries. Exponential growth is possible—one Goldman Sachs projection estimates that the Gulf economies could reach the size and prosperity of France by 2050—but it is hardly assured.[76] Moreover, questions persist about how much that growth will spill over to the rest of the region.

Some of the region's growth can be attributed to economic reforms, which gained momentum over the last five years. In Egypt, for instance, the government reduced personal and corporate income taxes by 50% to a maximum rate of 20%, cut tariff rates from an average 14.6% to 9%, and simplified customs procedures. For-

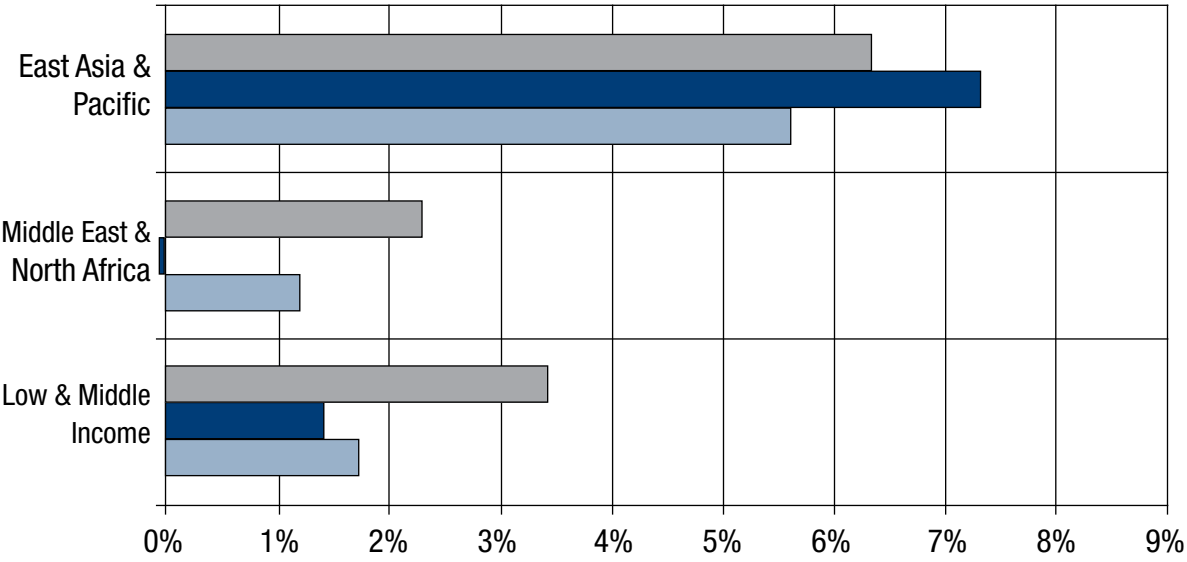
FDI in Morocco and Tunisia

After two foreign call center companies—the French firm Teleperformance and the Spanish firm Atento—established call centers in Morocco and Tunisia, local entrepreneurs decided that they too could serve the European market. Though the transition has been challenging, it forced the firms to differentiate themselves in order to establish a foothold in Europe. Local firms benefited not just from the demonstration effect of seeing foreign firms operate successfully from Morocco and Tunisia, but also by allowing the local firms to hire employees trained in foreign-owned call centers.

Source: *Global Economic Prospects 2008: Technology Diffusion in the Developing World* (Washington DC: World Bank, 2008).

[70] See Duncan, p. 41.
[71] "Egypt is open for business," *Korea Times* (July 22, 2007).
[72] James Bennett, "Bridging the Gulf: The Middle East petrodollar-fuelled boom will power ahead next year," *The Business* (December 15, 2007).
[73] Wagdy Sawahel, "Venture capital to boost innovation in Arab world," *SciDev.Net* (August 24, 2007).
[74] *The Coming Oil Windfall in the Gulf* (McKinsey Global Institute, January 2008).
[75] Deutsche Bank Research, "GCC chartbook: a visual essay," (February 8, 2008).
[76] See Duncan, p. 41.

Figure 26 Compound Annual Growth Rate of GDP Per Capita (%), 1976-2005



	Low & Middle Income	Middle East & North Africa	East Asia & Pacific
1996-2005	3.36	2.27	6.33
1986-1995	1.42	-0.03	7.33
1976-1985	1.83	1.10	5.57

Annual growth rate (%)

Source: calculated from World Bank Development Indicators, 2007.

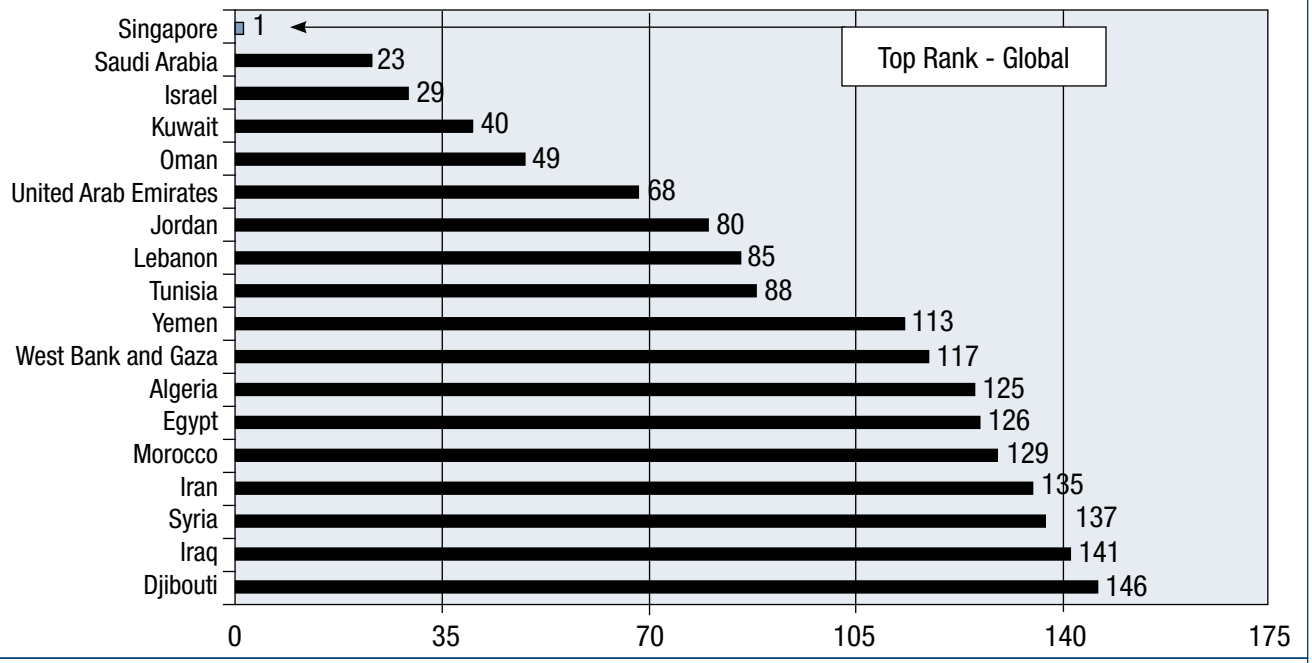
eign reserves increased from $14 billion in 2002 to $28.6 billion by the end of June 2007. Finally, companies can now be established in three days compared with a wait of three months just two years ago.[77] For these changes, Egypt is recognized as a top reformer in the world, according to the World Bank (Figure 28). Saudi Arabia, Djibouti, Tunisia, Kuwait, and the West Bank and Gaza are also credited with significant reforms. According to a Heritage Foundation/Wall Street Journal study, Bahrain ranks 19th in the world in terms of economic freedom, a measure of the ease of property ownership; mobility of labor, capital, and goods; and the economic liberty of individuals. Kuwait and Oman rank in the top 50 while Libya and Syria rank in the bottom 20 worldwide.[78] For most countries in the region, there has been little change on these measures since 2003.

Vibrant business communities support a knowledge society. They diversify economies, open new opportunities, give workers new training and skills, invest in innovation, and create jobs. Creating jobs in the private sector relieves government budgets and allows their allocation to other productive purposes. However, though unemployment in the region has declined, most new jobs still depend on public expenditure.[79] The growth of the private sector is a positive trend, but it is still small in global terms.

The 2003 AHDR urged governments to make it easy to create businesses, allowing people to take advantage of opportunities and quickly fill market needs. Facilitating entrepreneurship helps also to expand the benefits of growth to a larger share of the population. Whereas earlier oil booms led to growth that benefitted a small num-

[77] "Egypt is open for business," *Korea Times* (July 22, 2007).
[78] Index of Economic Freedom (Washington DC: Heritage Foundation and Wall Street Journal, 2008).
[79] Paul Dyer and Tarik Yousef, "Will the current oil boom solve the employment crisis in the Middle East?" *The Arab World Competitiveness Report 2007* (World Economic Forum), p. 32.

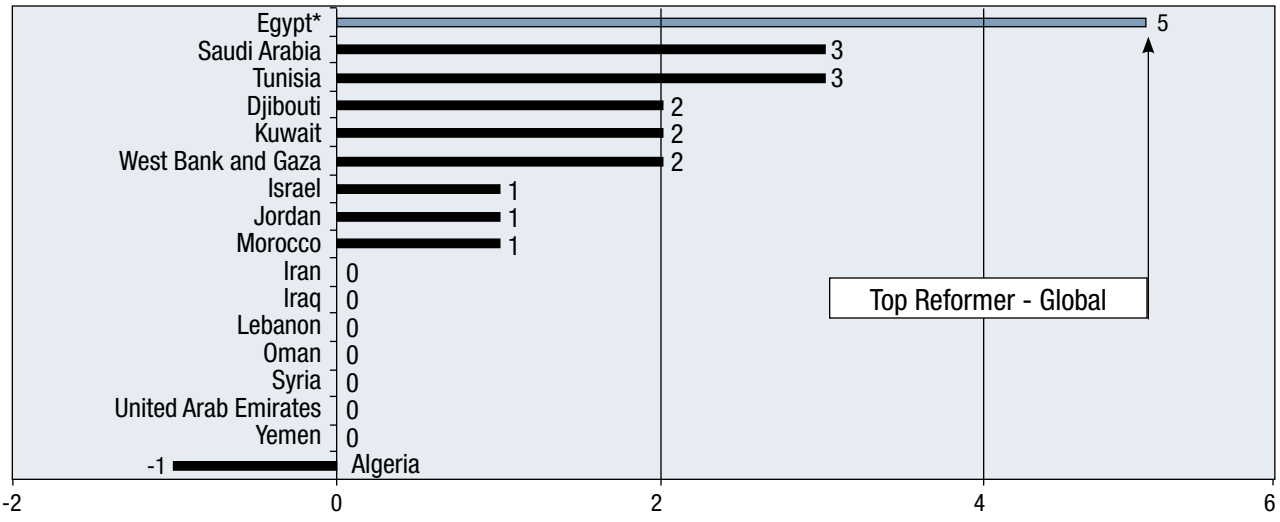
Figure 27 Economy Rankings—Ease of Doing Business, MENA Region Compared with Global Best Practice



Note: The ease of doing business index averages economy rankings on the 10 topics covered in Doing Business 2008.

Source: Reproduced from *Doing Business 2008: Middle East and North Africa*. The World Bank.

Figure 28 Net Number of Reforms, Doing Business Indicators, MENA Region



NOTE: The top reformer is determined based on the number of reforms implemented and the change in its ranking between 2007 and 2008.The method for counting net reforms is as follows: a value of 1 is assigned when a reform improves economic performance on one of the Doing Business indicators between 2006 and 2007. For example, if an economy enacts reforms to reduce the procedures and time to start a business and the cost to register property, two reforms are recorded. Negative reforms are counted similarly.

Source: Reproduced from *Doing Business 2008: Middle East and North Africa*. The World Bank.

Table 11 Micro, Small and Medium Enterprises, Arab Countries and Ireland

Country Name	Year	Businesses
Algeria	2001	580,000
Egypt	1998	1,649,794
Ireland	2003	97,000
Lebanon	1996	192,569
Morocco	2002	450,000
Oman	2004	7,373
Tunisia	1999	8,650
UAE	1995	82,440
West Bank and Gaza	2004	97,194
Yemen	2002	310,000

Source: World Bank Development Indicators, 2007.

ber of elites, expanding the business community based on merit will spread the benefits of growth. As Figure 27 shows, doing business is still too hard in Arab countries. Nonetheless, Figure 28 shows positive change.

Within the private sector, the 2003 AHDR identified the prevalence of low-skill micro-enterprises as an obstacle to a knowledge society, since they both demand and produce little new knowledge. The report pointed to Egypt, which in 1996 saw only 0.1% of its businesses employ more than 100 workers. Indeed, 98% of such enterprises employed fewer than three workers.[80] Unfortunately, the data in this area are weak, making longitudinal comparison difficult (see Table 11).

In addition to removing obstacles to business within societies, the 2003 AHDR urged Arab countries to open up to trade and investment with others in the region and the world. To a large extent, this is happening.[81] Since 2003, Saudi Arabia joined 11 other Arab states (Bahrain, Djibouti, Egypt, Jordan, Kuwait, Qatar, Tunisia, Mauritania, Morocco, Oman, and the UAE) as a member of the World Trade Organization. As discussed later, foreign investment into the region has also increased.

At the regional level, intra-Arab trade is up significantly, tripling between 2000 and 2005.[82] Trade within the region grew by 22% in 2005, up from 11% in 2004, and 8% in 2003. In 2005 alone, Egypt's trade with the region grew by 60%.[83] At the beginning of 2007, a full 43.9% of Jordan's national exports went to other Arab countries and the country welcomed 33.1% of its imports from the region.[84] Though subregional trade varies, with the GCC more integrated than the Arab Maghreb Union, in earlier years most trade occurred with partners outside the region.[85] Trade barriers remain, but rhetoric suggests that growth in intraregional trade will continue. The Greater Arab Free Trade Area (GAFTA), referenced in the original 2003 AHDR, plans an annual reduction of tariffs leading to the full liberalization of trade.

Facilitated by oil prices over $120 per barrel and low returns in developed countries, Arab countries increasingly are investing in each other. Since 2002, investors from GCC countries have exported approximately $700 billion in capital. Though much of this money has gone to developed countries, the International Institute of Finance estimates that North Africa and the Middle East attracted 22% of this GCC investment between 2002 and 2006. For instance, Mauritania recently welcomed a $375 million investment by Qatar Steel; stock markets in Egypt, Morocco, and Jordan are attracting new capital; and real estate investment is robust.[86]

Nonetheless, intraregional trade does not compare well with other economically vibrant regions. Whereas intra-Arab trade represents about 10% of total trade (20% if we take oil out of the equation), intraregional trade makes up 40% of trade in Asia.[87]

Global and regional integration is introducing a new level of competition to Arab markets. Competition drives innovation, leading the 2003 AHDR authors to advocate greater competitiveness in the Arab world. In 2007-2008, Kuwait ranked 30th in the world in terms of competitiveness, followed closely by Qatar, Tunisia, Saudi Arabia, the UAE, Oman and Bahrain (see Table 12). This represents a small step forward compared to

[80] AHDR 2003, p. 136.
[81] Stephen Glain, "Selling to the neighbors," *Newsweek International* (February 27, 2006).
[82] Steffen Hertog, "The GCC and Arab economic integration: a new paradigm," *Middle East Policy* Vol. 14, Issue 1 (April 1, 2007).
[83] "Egypt Minister Rachid to champion inter-Arab trade as a stepping stone to global integration," InfoProd (May 18, 2006).
[84] "GAFTA supplies 33.1% of imports," (April 11, 2007) and "GAFTA absorbs 43.9% of exports," (August 16, 2007) IPR Strategic Business Information Database.
[85] See Hertog.
[86] "Cash is gong to the poor, too," *The Economist* (February 23, 2008), p. 63.
[87] See Hertog.

Table 12 The Business Competitive Index, Select Arab Countries and Comparators

		BCI Ranking				Quality Of The National Business Environment Ranking				Company Operations And Strategy Ranking			
Country	GCI Ranking 2007-2008	2006	2005	2004	2003	2006	2005	2004	2003	2006	2005	2004	2003
Ireland	22	22	21	21	22	23	21	21	22	17	16	21	17
Tunisia	31	26	36	36	31	25	35	33	31	33	45	47	39
UAE	37	31	32	25	-	30	30	23	-	39	35	33	-
Qatar	32	34	41	-	-	33	39	-	-	44	69	-	-
Slovak Republic	41	40	43	43	43	39	43	43	43	45	54	42	46
Kuwait	30	44	40	-	-	44	40	0	0	59	65	-	-
Bahrain*	43	51	47	34	-	50	45	32	-	64	64	49	-
Jordan	49	52	42	44	36	51	42	42	35	70	56	58	56
Morocco*	64	66	76	45	49	62	75	47	49	80	82	46	49
Tanzania	104	73	78	74	62	71	77	71	63	75	98	78	65
Egypt	77	76	-	54	57	74	-	54	57	76	58	40	58
Algeria	81	85	89	84	86	82	85	82	81	112	11	94	96
Mongolia	101	99	91	-	-	98	93	-	-	104	95	-	-
Mauritania*	125	101	-	-	-	102	-	-	-	88	-	-	-
Ecuador	103	105	106	92	88	105	105	93	89	89	96	92	68

NOTE: * denotes countries that did not pass the data consistency test in 2005.

Source: *The Global Competitiveness Report 2007-2008*. Available at www.weforum.org/en/initiatives/gcp/index.htm.

earlier years. Some countries slipped. Algeria, Egypt, and Mauritania ranked lower than just a year earlier.

Innovation

Innovation—"the ability to manage knowledge, as embodied in technology, in a creative way in response to market requirements and the needs of society"—is indispensable to knowledge societies, according to the AHDR.[88] Since 2003, three Arab countries show improvement in innovation, as measured by a population-weighted composite score based on the number of researchers, patent applications, and science and technical journal articles: Algeria, Tunisia, and the UAE.

As discussed earlier in this report, the region still lags on many measures of innovation. The 2003 AHDR analyzed many dimensions of this shortfall, which persists today. A recent survey shows one dimension generating particular concern: Mourtamarat, INSEAD, and PricewaterhouseCoopers report that a lack of qualified personnel in the region is by far the greatest challenge to companies' ability to innovate.[89]

The 2003 AHDR noted the absence of professional networks as a debilitating factor in building a knowledge society—an observation we hear echoed in interviews with leading scholars and business people today. Compared with other world regions, Arab countries appear to feature fewer linkages among researchers, and between institutions of science, education and the business world. The lack of informal networks and formal civil society organizations linking professionals with similar interests leads to less collaboration and fewer opportunities for professional development.

Arab businesses must also learn to appreciate and listen to the talent they have. Though R&D contributes to in-

[88] AHDR 2003, p. 97.
[89] Dutta et al, p. 87.

novation, a 2006 IBM study of global CEOs indicated that more innovative ideas come from employees than from business partners, customers, consultants, competitors, associations/trade shows/conference boards, and internal sales and service units—in that order.[90]

In addition to a favorable political, social, and economic climate, innovation needs legal protection. As noted in the 2003 AHDR, intellectual property protection is necessary to shield individuals and industries that invest in knowledge-based products. "Disregard for intellectual property protection comes at a price for individual authors, published scientists and creative artists . . . It affects the national economy because value adding knowledge ceases to be produced when it is easily stolen."[91] Too little has changed on this front, with high costs for the region.

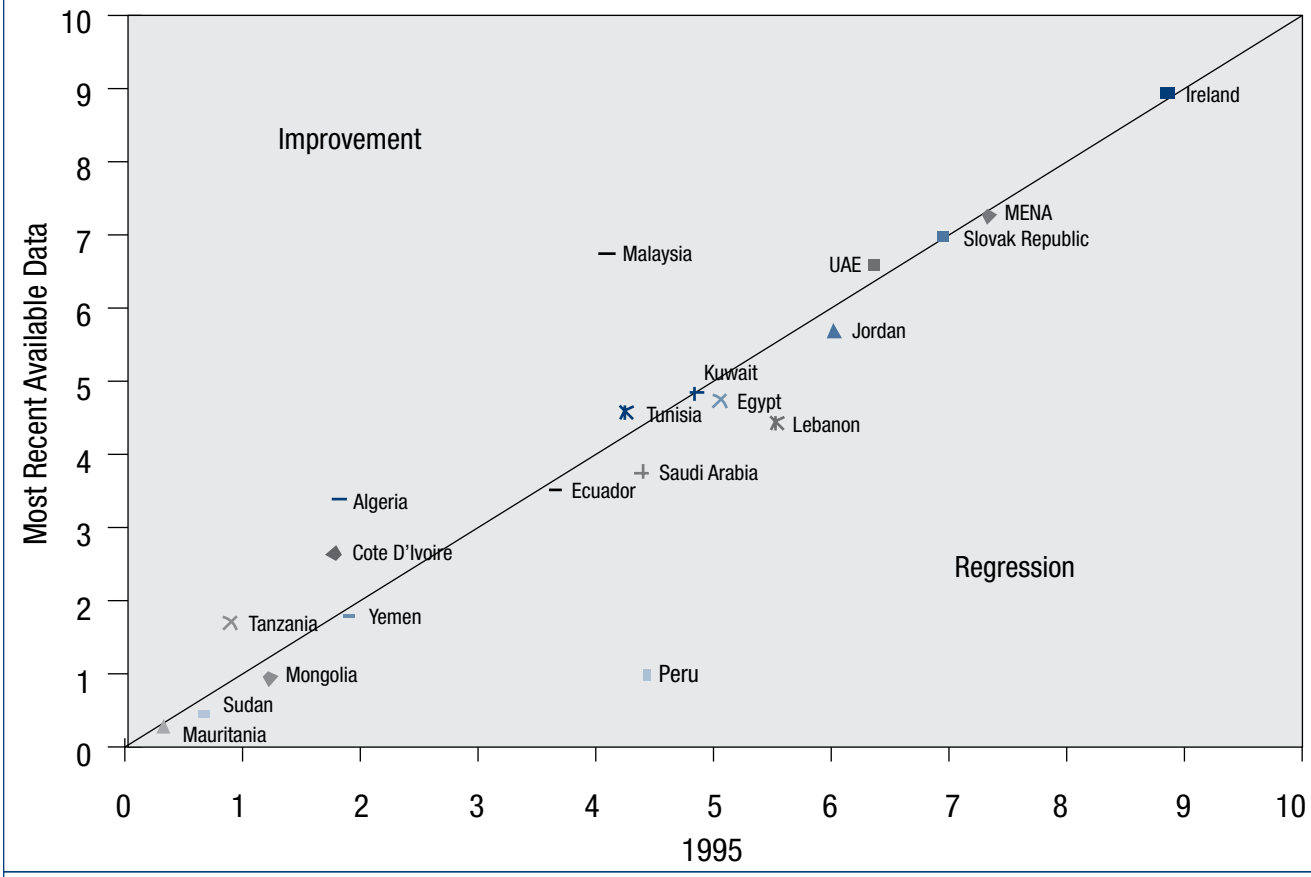
"Innovation does not depend solely on how individual enterprises, universities and research institutions perform, but also on how they interact with one another."

—Arab Human Development Report 2003

Though Egypt is the largest software producer in the region, the country could nearly double that sector by 2009 if it reduced its 65% piracy rate by 10%, according to one study.[92] Other policy changes, such as tax credits to promote research and development, business-friendly regulations, and reduced bureaucracy would also contribute toward a climate conducive to a knowledge society.

Foreign direct investment brings new ideas to knowledge societies. Compared with the period 1995-1999, FDI as

Figure 29 World Bank Innovation System Index Over Time: Select Arab Countries and Comparators

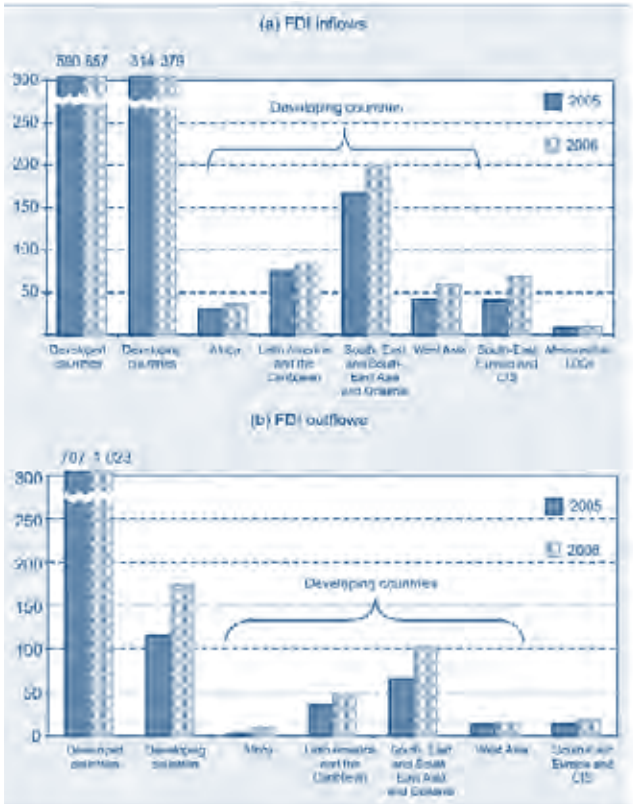


NOTE: Values are simple average (population weighted) of normalized scores on three variables: researchers in R&D, patent applications granted by the US Patent and Trademark Office, and science and technical journal articles.

Source: World Bank Knowledge Assessment Methodology (KAM) 2007. Available at www.worldbank.org/wbi/kam/.

[90] "The love-in: the move toward open innovation is beginning to transform entire industries," *The Economist* (October 13, 2007), Special report on innovation, p. 14.
[91] AHDR 2003, p. 156.
[92] International Data Corporation and Business Software Alliance study, cited in Dutta et al, p. 84.

FIGURE 30 FDI Flows by Region, 2005 and 2006 (billions of dollars)



Source: UNCTAD, "World Investment Report 2006", data from Annex B.1. Available at www.unctad.org/fdistatistics.

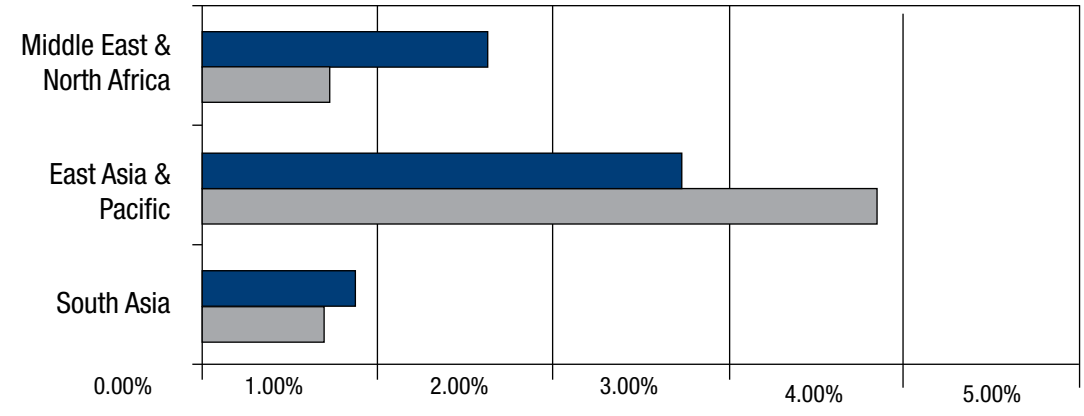
a percentage of GDP more than doubled between 2000-2005 (Figure 31). In 2005, only one Arab country—the UAE—ranked in the top 25 on AT Kearney's FDI confidence index.[93] In 2006, Egypt, Sudan and Tunisia each attracted more than $3 billion in FDI.[94] In 2007, the UAE ranked 8th in the world in terms of FDI and "other Gulf countries" ranked 17th.[95]

But, again, the region lags in comparative terms. Whereas the Middle East and North Africa attracted foreign direct investment worth 3.53% of GDP (normalized) in 2000-2005, East Asia attracted more than twice that amount.[96]

What is known nowadays as "Western" knowledge is itself an accumulation of human contributions throughout history, to which the Arab world contributed when the Arab-Islamic civilization flourished, and afterwards, through the Library of Alexandria. As world citizens, as contributors to the global stock of knowledge and as seekers of new knowledge the Arab peoples can, and should, embrace all opportunities to understand and relate to other cultures in the West and in the developing world.

—Arab Human Development Report 2003

FIGURE 31 Foreign Direct Investment (%) of GDP



	South Asia	East Asia & Pacific	Middle East & North Africa
2000-2005	0.86%	2.72%	1.62%
1995-1999	0.68%	3.84%	0.73%

NOTE: Calculated as the simple average of the annual FDI as percentage of GDP.

Source: World Bank Development Indicators, 2007.

[93] *FDI Confidence Index* Vol. 8 (Global Business Policy Council, 2005), available at: www.atkearney.com/shared_res/pdf/45130A_FDICI_2007.pdf.
[94] *World Investment Report 2007* (United Nations Conference on Trade and Development), p. 35.
[95] "New concerns in an uncertain world: the 2007 A.T. Kearny foreign direct investment confidence index," (Global Business Policy Council), available at www.atkearney.com/shared_res/pdf/45130A_FDICI_2007.pdf.
[96] World Bank Knowledge Assessment Methodology (KAM) 2007, available at www.worldbank.org/wbi/kam/.

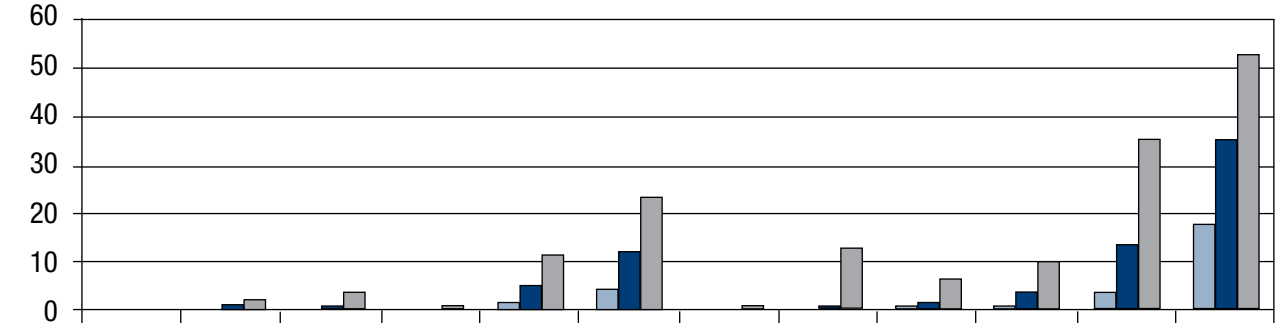
A KNOWLEDGE CULTURE

Strategic Vision: Establishing an authentic, broadminded and enlightened Arab knowledge model

A culture that values knowledge and innovation nurtures the continued growth of a knowledge society. Knowledge cultures provide social incentives that encourage investments of time and human energy in the production and dissemination of knowledge. To create a knowledge culture, the 2003 AHDR called for the delivery of "pure religion" from political exploitation, the honoring of *ijtihad* (reasoning) across Arab society, reform of the Arab language, and the embrace of cultural heritage and diversity. A shared Arab heritage of knowledge and science provides inspiration for the future. But, to create a knowledge culture, governments, civil society, cultural institutions, mass media, intellectuals, and the general public must all play a role, and embrace knowledge and innovation.

Earlier oil booms, the 2003 AHDR argued, fed a culture that valued wealth over creativity, status over knowledge. That oil wealth generally did not fund the institutions that cultivate a knowledge society over the long-term. With a new flood of oil money, and its potential spillover effects on non-oil producing Arab nations, in 2008 there is new hope—and some empirical evidence, presented earlier in this report—that this oil boom could

FIGURE 32 Personal Computers (per 100 inhabitants), Select Arab Countries and Comparators



	Comoros	Djibouti	Egypt	Algeria	Lebanon	UAE	Tanzania	Mongolia	Ecuador	Peru	Slovak Republic	Ireland
1995	0.03	0.69	0.43	0.30	1.66	4.77	0	0.34	1.31	1.49	4.10	18.30
2000	0.43	1.03	1.26	0.66	5.32	12.32	0.29	1.35	2.17	4.09	13.70	35.91
2005	0.68	2.75	3.78	1.06	11.45	23.35	0.93	12.84	6.55	10.01	35.72	52.99

Source: ITU World Telecommunication ICT Indicators 2007.

be different. There are also causes for concern, especially growing censorship.

Most importantly, questions persist about whether changes since 2003 are sufficient and what the future holds.

> *"Since the publication of the Development Report "Towards Establishing a Society of Knowledge" in 2003, the situation of knowledge in the Arab world has not budged a bit. Perhaps it has become worse. In countries like Iraq, Palestine, and Lebanon, intellectuals and pioneers of culture and knowledge, especially university professors, are subject to threat and assassination."*
>
> —Mohammed Bin Rashid Al Maktoum Foundation website 2008

The information environment is an area of both promise and concern. Internet access and mobile phone use are exploding. Ownership of personal computers is expanding across the Arab world (see Figure 32). Satellite television is reaching millions of homes across the Arab world, opening up new possibilities to use entertainment as a vehicle for early and life-long education.

Yet, a culture of censorship is spreading to areas of previous openness. Internet censorship is proliferating. New technologies to control text messaging are available. Even the satellite television channel Al Jazeera, a leader in challenging conventional wisdom and engaging the broad Arab public, is facing new levels of control.[97] In February 2008, the Arab League voted by an overwhelming majority to adopt a new charter that could be used to restrict broadcasting freedom across the Arab world.[98]

Since 2003, key institutions of knowledge have grown. The Bibliotheca Alexandria (see sidebar) is even more active and dynamic than when it was described by the 2003 AHDR. Higher education institutions are expanding, as discussed earlier. Scientific organizations, such as the Beirut-based Arab Academy of Sciences, have become more active.

Bibliotheca Alexandrina

Opened in 2002, the new library at Alexandria, Egypt seeks to recapture the legacy of the original Alexandria library, an intellectual center of the ancient world. Like its ancient ancestor, the new library seeks to be a center of excellence in the production and dissemination of knowledge and a place of dialogue, learning and understanding between cultures and peoples. The library now welcomes approximately 800,000 visitors per year from Egypt and around the world.

The Bibliotecha is a traditional library, housing books, printed resources, and research support services. It also houses a planetarium, museums, exhibitions, cultural performances, and multimedia displays. A major center for conferences, the library promotes dialogue on governance and reform, science and technology, arts and culture, and the role of women. It serves as an important partner for scientific, cultural, and educational institutions worldwide.

Two aspects of the library deserve special mention. First, the Bibliotheca has aggressively capitalized on opportunities presented by information and communications technologies. Library patrons can access 21 core databases and 19,584 scholarly electronic journals, e-book databases, and other Internet resources. Patrons conduct over 100,000 electronic searches every year. In addition to making electronic resources available, the library has emerged as a leader in the digitization of Arabic manuscripts, maps, books, and pictures as well as an active participant in global campaigns to make knowledge universally accessible. In this spirit, the library has invested in its own state-of-the art digital laboratory.

Second, the library seeks to reach out to the general public, especially young people. The library includes special collections for youth, as well as cultural performances and programs designed for young audiences. The library's Planetarium Science Center also engages children in order to cultivate their interest in science.

[97] Robert F. Worth, "Al Jazeera no longer nips at Saudis," *The New York Times* (January 4, 2008). For a detailed analysis of the evolution of Arab satellite television, see Marc Lynch, *Voices of the New Arab Public* (New York: Columbia University Press, 2006).
[98] James Robinson, "Al-Jazeera head attacks Arab League," guardian.co.uk (February 19, 2008).

There are small signs of dynamism in the field of culture. Arab cinema, for instance, is booming. Morocco boasts a $1 billion new "Film City." Challenging the long-term dominance of Egypt, GCC countries now produce 120 films of all types each year, up from just a few annually earlier this decade. Abu Dhabi signed a $2 billion deal with Warner Brothers to open a megastudio in the region. Dubai built a fully equipped film production set called "Studio City."[99] To give another example, singers, popularized by satellite television, reach broad region-wide audiences.[100]

Translation is an essential means to transfer knowledge to and from the Arab world. Yet, in 2002 the original Arab Human Development Report observed that the entire Arab world of approximately 300 million people translates about 330 books annually, one-fifth the number Greece translates. Though we see no evidence that this situation has changed since then, a new non-governmental organization named Kalima intends to translate 100 books per year into Arabic. Kalima announced the first 100 titles in November 2007. Other initiatives in the UAE and Egypt plan to translate hundreds more. If these translation projects are successful, the flow of new ideas into Arab countries will increase dramatically in the coming years.

But translation cannot reach the illiterate. As Table 13 shows, regional illiteracy rates are still extremely high. As in 2003, adult literacy remains a major challenge. The Arab League Education, Science and Culture Organisation (ALESCO) reports that among its member countries, illiteracy afflicts 70 million people over the age of 15.[101]

Table 13 Literacy Rates for the population aged 15 years and up, 2007, Select Arab Countries

Country	%
Algeria	75.4
Bahrain	88.8
Egypt	72.0
Jordan	93.1
Kuwait	93.9
Libya	86.8
Mauritania	55.8
Morocco	55.6
Oman	84.4
Palestinian Territories	92.8
Qatar	90.2
Saudi Arabia	85.0
Sudan	60.9
Syria	83.1
Tunisia	90.4
UAE	72.3
Yemen	58.9

Source: UNESCO Institute for Statistics (UIS) 2007. All data are UIS estimates produced by the UIS Global Age-Specfic Literacy Projection (GALP) model using the latest available country data.

[99] "A new Arab Hollywood," *Middle East Notes and Comment* (Washington DC: CSIS, December 2007).
[100] Hassan M. Fattah, "A familiar set helps to create a new cultural market," *The New York Times* (August 2, 2007), p. A4.
[101] "Increasing number of Arabs illiterate," Al-Jazeera.Net (January 17, 2005).

LOOKING FORWARD

Human development will advance through the creativity and initiative of each Arab society. These societies must chart their own paths, recognizing their own unique challenges and potential. Though they can—and should—learn from others, they ultimately must shape their own destinies.

Arabs need not build knowledge societies directionless or alone. Useful models exist in distant countries as well as neighbors like Turkey and Iran. Foreign governments, universities, research institutions, and businesses are valuable potential partners. Arab societies can build stronger cooperative partnerships and help each other forward. Most importantly, Arabs can unleash the potential within their own societies by spreading and strengthening knowledge institutions: universities, civil society organizations, private companies, scientific academies, and professional networks.

Five years ago, the AHDR illuminated a path to an Arab knowledge society that would benefit the Arab region and the broader global community. This study suggests practical steps to advance along that path. These steps will not be appropriate for every society and should be debated vigorously. We offer them in the spirit of dialogue, in hopes that they will be considered by Arabs, in service to Arabs and their collective future.

Governance

If Arabs seek human development through knowledge, freedom is the first and all-defining step.

—Arab Human Development Report 2003

Good governance is an essential foundation of knowledge societies. Governments can create climates in which knowledge and knowledge-based industry flourish. They can enlighten young minds, nurture creativity, and nourish scientific inquiry. By allowing citizens to enjoy basic freedoms of expression and association, they can allow citizens to participate in their own governance. By applying laws fairly and equally, governments support their own businesses and attract investment into their societies. Without good governance, achieving a knowledge society that simultaneously advances human development, innovation, and economic growth will be difficult, if not unachievable.

- Censorship impedes the free exchange of ideas and obstructs progress. Though security threats may be all too real in some instances, censorship will chill the advancements needed to create a knowledge society and undermine security threats in the medium to long term. Reversing recent infringements on freedoms of expression, in all forms of media, will enable the productive exchange of ideas necessary for a knowledge society and empower competitive industries.

- Enhancing the rule of law will create a more fertile environment for investment, which brings technology, skills, and ideas along with financial resources. The rule of law is upheld through the fair and predictable application of law and transparent and accountable governance. Such advances also minimize corruption, which saps public trust in leaders and discourages investment. Less corruption, in turn, ensures that public investments can create maximum returns.

- A stronger commitment to transparency will promote informed dialogue in Arab societies. Several Arab societies have shown interest in joining the approximately 70 nations worldwide with freedom of information laws. Such efforts deserve encouragement and should spread across the region.

- Governments increase their legitimacy by expanding participation and serving their publics. The success of governance should be judged by performance. Transparent goals, widely communicated and carefully monitored, provide the basis for accountability. Publicly accessible databases of statistics, provided to international bodies like the World Bank, allow for verification, analysis, and ideas for improvement. Governments can deliver services better by employing new technologies. There is no automatic link between the use of information and communications technologies and good governance. However, e-governance, properly applied, can increase transparency, efficiency, and public satisfaction with governments—all of which lay valuable groundwork for a knowledge society.[102]

- Governments, in cooperation, can facilitate the free and secure movement of people. Researchers, students, and business people accomplish much when they are able to circulate and collaborate easily. Where policies impede them, new policies can aid them.

- Large populations will place new burdens on governments. These citizens need high quality education and jobs outside the public sector. Governments must find new and innovative solutions to these challenges by expanding educational opportunities, helping university students to study abroad and then come home, facilitating closer ties between schools and employers, and unleashing the power of the private sector.

Education

The quality of education, a long neglected priority in Arab societies, is as important as the availability of education in building the foundations of knowledge.

—Arab Human Development Report 2003

Knowledge societies depend on education. Education, at all levels, for all members of societies, cultivates the creative and intellectual development on which innovation depends. Providing education to all is a worthy and necessary objective. It is also insufficient. Education must be high quality and lifelong, stretching from early childhood throughout adulthood. It is a never-ending challenge, but meeting this challenge rewards individuals as well as whole societies.

- Quality—ensured through high standards, testing, evaluation, and accreditation—should be the centerpiece of efforts to improve education. Investing money alone will be insufficient. Indeed many Arab countries already spend far more than the global average on education. How societies allocate their education resources will be at least as important as how much they allocate; investment of financial resources does not lead inevitably to better educational outcomes. To improve the quality of education at all levels, educational institutions and governments must commit to international measures of performance, which allow longitudinal and comparative assessment of educational standards and also provide the basis of accountability. In higher education, universities can apply the standards of global accrediting bodies, empower autonomous bodies to evaluate performance against these standards, and create mechanisms to monitor and ensure quality within institutions of higher learning. To do this effectively, local staff must receive training in evaluation and assessment. Universities should be evaluated in accordance with both global and regional standards. Since Arab universities prioritize teaching above research, they must adopt measurements that re-

[102] "E-governance," in *UNDP Essentials*, No. 15 (New York: United Nations Development Programme Evaluation Office, April 2004).

flect this commitment. Quality will also advance through teacher training, an established lynchpin of educational achievement.

- Societies must find ways to serve the many young people who will need education over the coming decades. High quality private education, regional competition in the higher education sector, and high quality vocational education aligned to market needs should be encouraged, with students allowed to vote with their feet. Coping with large numbers of students while increasing quality is admittedly challenging, but must be accomplished nonetheless.

- At all levels, education that promotes inquiry, critical thinking, and problem-solving will develop the skills necessary for a knowledge society. Rote learning and instructor-centered approaches to education remain the norm, though there are numerous pilot efforts at change. Societies should also develop basic technological literacy among students to prepare them for jobs in a knowledge society. Organizations in the public, private, and non-profit sectors can all contribute to achieving this goal.

- In the area of higher education, universities must reach beyond their own walls and build partnerships with other universities and businesses. Closer collaboration between universities and the private sector will ensure that universities provide students with the skills and knowledge they need to fill the jobs of both today and tomorrow. Interaction with business helps to inform the curricula and also smooth the transition from school to the job market. Opportunities for internships and short-term employment during school breaks, as well as projects assigned to students by private employers, expose students to the world of work and allow businesses to see what talent is available.

- Lifelong learning—now a requirement for all members of society at all educational levels—can be aided by information and communication technologies that facilitate distance learning, opportunities for informal education, participation in professional organizations, and networking.

Science, Technology, and Innovation

Various components feeding into R&D must be developed simultaneously. These components include educational systems and standards, basic and applied research institutions, ICT infrastructure, services, and information systems, funding institutions, professional societies, consulting services, technical support systems and science education for students and the public at large.

—Arab Human Development Report 2003

Advancements in science and technology promote both human and economic development. For the Arab world, a region-wide renaissance in science, technology, and innovation will require long-term investment, focused effort, and reform. It will also require inspiration. The region thirsts for success stories. Accomplished women, young people, scientists, engineers, technologists demonstrate to others that they too can succeed, within the region and for the region. Stories of such heroes are now too few and told too quietly.

- Research, the focused quest for new knowledge and new applications of existing knowledge, must be a priority. Funding is insufficient, for basic costs like salaries and equipment as well as ambitious research programs. Professors, faced with massive student populations, are forced to neglect research in service to students. Incentives to conduct research are too few. Research will have broader support if it is linked closely to local health, environmental, and economic development needs. Even disadvantages, such as the high incidence of diabetes in the UAE, provide opportunities for researchers who seek a cure. Facilitating their research advances science, enhances the skills of local researchers, and provides services to citizens who could benefit from cutting edge treatment.

- Building a critical mass of scientists, engineers, and researchers facilitates technological progress in particular fields. Arab societies should assess their strengths and build on them, supporting centers of excellence. A 2008 study by COM-

STECH, the Standing Committee on Scientific and Technological Cooperation of the Organization of the Islamic Conference, lays useful new groundwork by evaluating national strengths in science and engineering.[103]

- Policies that lure scientists and engineers, especially those with ties to the region, help to build a critical mass of talent. Other societies, such as China, demonstrate that reversing brain drain—and benefitting from brain circulation—is both possible and valuable.[104] To attract top thinkers, Arab societies must entice them with research funds, equipment, and access to other researchers and graduate students. Focusing on areas of comparative advantage will lead to greater returns on investment.

- Appreciation of science and research should be cultivated outside of schools and laboratories as well as through formal education. Science clubs and museums, competitions, and prizes spur interest in science, especially among young people. Educational opportunities in science and engineering must meet global standards and prepare young people to contribute productively to a knowledge society and their own futures. Philanthropists can provide vital support in meeting this objective.

- Merit-based academies of science are too few in number. Such academies not only confer prestige on their members, they provide essential advice to governments, raise the profile of science among populations, support the application of science and technology to advance national economic and social objectives, and advocate for science, engineering, and research.[105] Scientifically-backed advice should not be restricted to such academies. A vibrant marketplace of ideas with multiple civil society organizations will give societies and governments the insights they need to address difficult challenges.

- Scientific institutions must build stronger ties to markets. Such interaction encourages applications of knowledge that serve local needs, spurs economic growth, and fosters innovation. When businesses benefit from research, they have incentives to fund it, creating more resources for science. To accomplish this objective, business people and researchers must find new fora in which to interact. Scientists and engineers should be given large incentives to develop commercially viable products, encouraging others to follow their example.

Knowledge-Based Industry

> *The state, the business sector and higher education institutions should unite to build consultancy and technology-launching centres and to create an atmosphere conducive to knowledge production through innovation.*
>
> —Arab Human Development Report 2003

Knowledge-based industry creates high value goods and services, contributing to diverse and robust economies. Such industries demand skilled employees, creating opportunities for talented individuals within the Arab region. Dependent on innovation, they devote resources to research and development with both local and global applications. Yet, to achieve this virtuous cycle in which resources combine to create new opportunities, knowledge-based industries need fertile soil in which to grow.

- Better business conditions will improve the ecosystem for competitive industries in all sectors. It is still too hard to start businesses in many countries. Infrastructure is insufficient. Intellectual property needs more vigorous protection. On average, Arab businesses must go through 40 proce-

[103] S.T.K. Naim (ed.) *Leading Scientists and Engineers of OIC Member States* (Islamabad: COMSTECH Secretariat, 2008).

[104] China's success in this respect has many explanations. A few factors are worth noting: China announced a doubling of R&D spending by 2010 to $69 million; it is encouraging researchers through looser regulation of certain types of experiments and by allocating public money for new laboratories, grants and tax breaks. 81% of members of the Chinese Academy of Sciences, a government affiliated research institute, are returnees who earned doctorates in science and engineering abroad and 50,000 of returnees are starting S&T companies. Ariana Eunjung Cha, "Opportunities in China lure scientists home," *The Washington Post* (February 20, 2008), p. D1.

[105] Of the 98 national scientific academies that are members of the global InterAcademy Panel, only four are from the Arab world: Egypt, Jordan, Morocco, and the Palestinian Autonomous Territories. The UAE announced the launch of a new national authority to coordinate and fund scientific research in March 2008. Wagdy Sawahel, "UAE launches national authority for scientific research," SciDev.Net (March 14, 2008).

dures to enforce a contract, a number higher than any other region of the world and a full one-third higher than the global average.[106] In addition to improving the business climate through well established standards, governments and business councils can take an industry-by-industry approach, asking how best to stimulate competition and growth in each sector. They can provide attractive incentives for entrepreneurs, who create jobs for others as well as themselves.

- Human potential is wasted too often. The most educated are also the most likely to be unemployed. More women achieve higher education than men, but transitioning to the job market is difficult. Men need more opportunities to achieve higher education and women and men need more employment opportunities after university, facilitated by close partnerships between universities and business. To address these issues, men and women alike need strong mentors, support from universities and non-governmental organizations, and the commitment of locally based businesses. More regional cooperation, bringing together countries that are capital-rich and labor-poor with their opposites, will benefit all and capture the rewards of applied human talent.

- To stimulate human potential, the region can launch more business plan competitions and public-private partnerships with young entrepreneurs. They can increase incentives to encourage local outsourcing and supply chain development, rewards for those who start and grow businesses, and opportunities to travel and work within the region. Locally based businesses can play a major role in supporting these initiatives.

- Ideas flow along with trade and investment. Governments should encourage foreign direct investment and trade, especially intraregionally. Intraregional cooperation on economic, scientific, and technological issues would be particularly advantageous, enabling the region to compete more effectively in the global economy. Arab societies must also take better advantage of these opportunities, giving investors incentives to enhance local capacities and transfer technologies and knowledge.

- Exposure to new ideas and skills through trade and foreign direct investment will not inevitably lead to technological advances. Arab societies must develop their capacity to absorb technology. In addition to a favorable business climate, employees must have the basic technological literacy to implement technologies as well as the advanced research skills necessary to understand, adapt, and implement imported technologies.[107]

- Arab societies must develop indigenous technological capacity, funded by firms as well as governments. To support this objective, they can develop networks of suppliers and link local producers to larger markets. Developing such networks is a useful function for governments, development banks, and non-government organizations, which can lower barriers for local firms seeking to enter large new markets. Investing in information and communications technologies can increase productivity and also boost innovation.

A Knowledge Culture

> *The establishment of an authentic, broadminded, and enlightened Arab general knowledge model requires essential reforms in the societal context in Arab countries.*
>
> —Arab Human Development Report 2003

A culture that values education, science, innovation and entrepreneurship nourishes a knowledge society. For Arab societies, this culture is lacking. But a rich heritage of knowledge, combined with abundant opportunities for global engagement, could lead this culture to flourish once more.

- Cultural change must come with the future in mind. Children should learn to value science and inquiry, creativity and innovation. They should

[106] See *The Road Not Traveled: Education Reform in the Middle East and North Africa*, p. 230.
[107] *Global Economic Prospects 2008: Technology Diffusion in the Developing World* (Washington DC: World Bank, 2008), p. 108.

learn this in school, drawing on the natural curiosity of youth and an understanding of the Arab world's contribution to science. To lower the barriers between children and science, they should experience science out of the classroom in museums, clubs, camps and extracurricular activities that make learning fun.

- Respected figures, from religious leaders to Nobel Prize winners, can endorse education and science. They can grant legitimacy to these pursuits and emphasize that science and education serve the greater good. Celebrities, for their part, can lend glamour to the causes of entrepreneurship and discovery.

- The media must embrace the vision of the knowledge society. Journalists—especially on satellite television—can report intriguing breakthroughs, tell stories about Arab success, and spotlight young entrepreneurs, artists, engineers, and scientists. Television networks can feature documentaries and reality shows that introduce new concepts, competition, and a spirit of enthusiasm.

- Via the Internet, the Arab world can create new content for large audiences. With so little Arabic language content available on-line, individuals have the potential to make a large impact in a short time.

- Literacy is a prerequisite of the knowledge society. Arab countries must reduce illiteracy, using pedagogies and educational programs tailored to adults and their schedules.

- Gulf oil export revenues will total over $9 trillion by 2020, according to McKinsey & Company.[108] Wealth can fund scholarships, research, translation projects, exhibits, employment preparation, and venture capital. When individuals know that hard work and initiative can lead to advancement and growth, dynamism supplants cynicism.

Conclusion

Building a knowledge society across the Arab world is the only way to lead the region into a renaissance that can change its present course and help all Arab countries to position themselves on a new and much more helpful curve of development in the region and contribute to a new world for humanity at large.

—Arab Human Development Report 2003

Building an Arab knowledge society will require the focused efforts of individual societies, regional cooperation, and global engagement. It will require knowledge of how the region—and countries within it—are faring and why past investments have not always led to greater achievements. It will necessitate bold steps, careful planning, substantial investment, and exponential growth to bridge the divide between the Arab world and other regions. Fortunately, the resources—and increasingly the will—are available and even abundant.

- Better data is a critical need. Without good data, it is difficult to measure progress, know when goals are achieved, understand when to change tactics, and allocate resources. It is hard to hold leaders accountable and reward success. This data must be accessible and verifiable, in accordance with global standards and reflective of local needs. Data that show whether investments impact society positively can help governments and other institutions make the case for further investment.

- Compared with other regions, intraregional cooperation is extremely limited. Greater mobility of capital, goods, services and people would lead to more innovation, greater efficiency, and more productive economies across the region.[109]

- Tangible success—in governance, education, science and technology, industry and innovation—will have a powerful demonstration effect. Leaders in all these sectors should focus on achievable short-term goals as well as long-term strategies, in

[108] *The Coming Oil Windfall in the Gulf* (McKinsey Global Institute, January 2008).
[109] The March 2008 agreement between Algeria and Egypt to strengthen cooperation in health and science is a promising development but too early to assess. Hichem Boumedjout, "Algerian research to benefit from Egyptian experience," SciDev.Net (March 13, 2008).

order to head off frustration and encourage further advances. Investing in centers of excellence will both build and showcase strengths.

- A comprehensive approach is necessary. Though this report has addressed the components of knowledge societies separately, in fact they are interdependent and intricately intertwined. Success in one area can stimulate success in others. Failure in one area can undermine success more broadly.

- Openness is vital. Like all societies, Arabs will achieve success through the power of networks and partnerships, competition, and cooperation. In a global economy, societies are stronger when they engage those with common interests and adapt in response to challenges. Societies should encourage "brain circulation" in which individuals learn, work, and travel in foreign countries and then return home enriched. They should engage diaspora populations whose knowledge, insights, and investments can contribute meaningfully to human development. Arabs should build their own professional societies, especially in science and engineering, and join global chapters of civil society organizations. In short, they should interact as much as possible with the best and brightest in their own societies and around the world.

In sum, Arab societies have progressed in the five years since the 2003 Arab Human Development Report. In education and science and technology, economic vitality and culture, Arab societies are advancing. These gains deserve recognition.

Yet, the progress of Arab societies is still inadequate to the challenge. In education, science, and industry, Arabs are advancing, but slower than they might wish. Other regions are sprinting forward, leaving Arabs behind. In the area of governance, there is retreat. Freedoms are slipping, imperiling creativity and long-term innovation.

There is hope for the future. Arab societies contain vast human potential. They are both vigorous with youth and vessels of a proud heritage of knowledge. Through analysis and dialogue, they may decide to choose new paths. They can rekindle the flame of Arab learning and sustain a new Millennium of Knowledge.

> *Arab heritage declares that knowledge must shine through all the endeavours of humankind. What has blotted out that light is the work of mortals: the defective structures – political, social and economic – that have hidden knowledge from the Arab people and eclipsed its full possibilities. Yet what human beings have wrought human beings can remove, and must, so that the flame of Arab learning can once again burn bright and long in this new Millennium of Knowledge.*
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> —Arab Human Development Report 2003

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Abdalla Abdelaziz Alnajjar is President and CEO of the Arab Science and Technology Foundation (ASTF), a Sharjah-based nongovernmental organization aimed at identifying and supporting outstanding scientific research activities being conducted by men and women of science and technology from the Arab world. In addition, Alnajjar is an associate professor of Physics at the University of Sharjah.

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Moneef R. Zou'bi is the Director General of the Islamic World Academy of Sciences (IAS), which is an international non-governmental academy of sciences founded by the heads of states of the Organisation of the Islamic Conference. Previously he occupied the positions of Technical Affairs Director, and Deputy Executive Director of the IAS. He lived and studied in the UK and graduated from Loughborough University in 1987. His interests include Information Technology, the Environment, S&T Policy, and the History of Science. He previously worked with several consulting firms both in Jordan and UK before joining the IAS in 1990. He has published extensively on S&T issues and co-edited a number of books.

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Kamel Ayadi is a member of the Tunisian Chamber of the Senate. He served as Secretary of State in the Tunisian government from 2004 to 2006 and as President of the Tunisian National Authority of Regulation of Telecommunications from 2001 to 2004. After having served in leadership positions in numerous engineering societies, he was elected in October 2003 as the president-Elect of the World Federation of Engineering Organisations and became President in October 2005. He is a member of such international organizations as the Strategy Council of the United Nations Global Alliance for ICT Development and the United Nations Task Force for Science. He has authored more than 50 papers on several topics including ICT, science and technology, and education. He received a B.A. in Civil Engineering from the Tunisian High Institute of Engineers and a J.D. from the Tunisian University of Law.

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Hasan Salah Dweik is the Executive Vice President of Al-Quds University. In 1983, he established the Department of Chemical Technology at the faculty of Science and Technology in Jerusalem and chaired it until 1989. From 1991-1992, Dweik was a Fulbright visiting professor to Akron University and Ohio State University. Later, he became the head of the Department of Food Technology. From 1999-2002, he served as the Dean of the Faculty of Science and Technology. From 2004-2005, he was the acting president of the University, and in 2005, became the Executive Vice President. He has published a number of articles and conducted research on polymer technology, water issues and pollution, solid waste management, and most recently on nano polymers. Dweik earned his B.Sc. in chemistry at the University of Jordan in 1976. He received an M.A. in the field of stabilization of Polymers from the University of Aston in Birmingham in the United Kingdom and a PhD in Rubber Technology in 1983.

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Omar El-Arini is Honorary Chief Officer of the Multilateral (Ozone) Fund for the Implementation of the Montreal Protocol. He is also a senior advisor to the Egyptian government in the areas of the environment and the conservation of Egypt's national patrimony, and is a board member of the Egyptian Environment Affairs Agency. Prior to joining the Fund, El-Arini held research positions in Egypt, Germany and the Netherlands. He also managed a large portfolio of research projects funded by the United States Government in Egypt. He has held senior positions in the Government of Egypt, as well as teaching positions in Cairo University and the American University in Cairo. El-Arini holds a B.Sc. degree from Ain Shams University (Egypt), a M.Sc. from the University of Missouri (USA), and Ph.D. from the Imperial College of Science, Technology and Medicine (UK).

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Mustafa El Tayeb is Director of the Division for Science Policy & Sustainable Development at the United Nations Educational Scientific and Cultural Organization (UNESCO). El Tayeb joined UNESCO in 1981, and in 1986, assumed the post of the Chief of Section responsible for Arab States and Africa. Between 1989 and 1996 he worked as the Chief of Development Analysis and Operations, assisting UNESCO Member States in formulating science policies, strategies and development of partnerships between universities and industries and the evaluation of higher education institutions and universities. In 1996 El Tayeb was appointed Director of the Division of Policy Analysis & Operations of UNESCO. The Division of Science Analysis & Policies launched an ambitious program of assistance to member States in the evaluation of their national systems of innovation. He is a Founding Member of the Arab Academy of Sciences, a Corresponding Member of the Royal Academy of Overseas Science (Belgium), the Secretary of the UNESCO-EOLSS Joint Committee in Charge of the Encyclopedia of Life Support Systems and Editor-in-Chief of the UNESCO Science Report. El Tayeb holds an Engineering Diploma from St. Petersburg (Leningrad) Mining Institute, and a M.S. and Ph.D. in Geophysics from Bordeaux I University in France.

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Amr Gohar is CEO and Managing Director for NTCC, a telephone service provider, and Chairman of CELLTEK, which offers a broad range of ICT professional services. He also serves as Chairman of ECCO, a company that specializes in offering out-sourcing, in-sourcing contact center services. Previously, he served as Lucent Technologies Regional Director, Marketing and Sales in the Middle East. In addition, Gohar is a board member of the Egyptian Junior Business (EJB) Association and Head of Entrepreneurship Committees, and is a member of Egypt Industry Entrepreneurship Council, Ministry of Trade & Industry. He received his BA in Telecom Engineering from Ain Shams University in Egypt and an MBA from Maastricht School of Management in the Netherlands.

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Mohamed H. A. Hassan is President of the African Academy of Sciences (AAS). He is Executive Director of the Academy of Sciences for the Developing World (TWAS), Trieste, Italy, Secretary General of the Third World Network of Scientific Organizations (TWNSO) and serves on a number of committees in other organizations worldwide. He was born in the Sudan in 1947, and holds a Ph.D in Plasma Physics from the University of Oxford, UK (1974). A former professor and dean of the School of Mathematical Sciences at the University of Khartoum, he has received a number of scientific awards. His research areas include theoretical plasma physics, physics of wind erosion and sand transport.

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Kristin Lord is Associate Dean for Strategy, Research, and External Relations at The George Washington University's Elliott School of International Affairs and a Nonresident Fellow in the Foreign Policy Studies Program of the Brookings Institution, where she convenes the science and technology working group of the U.S.-Islamic World Forum. In 2005-2006, Lord served as a Council on Foreign Relations International Affairs Fellow and Special Adviser to the Under Secretary of State for Democracy and Global Affairs. She is the author of *Perils and Promise of Global Transparency: Why the Information Revolution May Not Lead to Security, Democracy*

or Peace, (SUNY Press, 2006), *Power and Conflict in an Age of Transparency*, edited with Bernard I. Finel (Palgrave Macmillan, 2000), and numerous book chapters and articles. Lord received her Ph.D. in Government from Georgetown University.

Karim Nagy (United Arab Emirates)

Karim Nagy is an entrepreneur currently living in Abu Dhabi. An Egyptian national who is involved in multiple technological manufacturing projects, Nagy is also an active social entrepreneur. He recently founded Kalima, an NGO that translates contemporary and classical publications into Arabic. His motivation is to spread knowledge, ideas, and tolerance by widening access to great works in the Arab world. Before setting up his own group of companies in Abu Dhabi, Karim worked in business development, investment and private equity. In his earlier career, he was a consultant for McKinsey & Company.

Project on U.S. Relations with the Islamic World

The Project on U.S. Relations with the Islamic World is a major research program housed within the Saban Center for Middle East Policy at the Brookings Institution. The project conducts high-quality public policy research, and convenes policymakers and opinion-leaders on the major issues surrounding the relationship between the United States and the Muslim world. The Project seeks to engage and inform policymakers, practitioners, and the broader public on developments in Muslim countries and communities, and the nature of their relationship with the United States. Together with the affiliated Brookings Doha Center in Qatar, it sponsors a range of events, initiatives, research projects, and publications designed to educate, encourage frank dialogue, and build positive partnerships between the United States and the Muslim world. The Project has several interlocking components:

- The U.S.-Islamic World Forum, which brings together key leaders in the fields of politics, business, media, academia, and civil society from across the Muslim world and the United States, for much needed discussion and dialogue;
- A Visiting Fellows program, for scholars and journalists from the Muslim world to spend time researching and writing at Brookings in order to inform U.S. policy makers on key issues facing Muslim states and communities;
- A series of Brookings Analysis Papers and Monographs that provide needed analysis of the vital issues of joint concern between the U.S. and the Muslim world;
- An Arts and Culture Initiative, which seeks to develop a better understanding of how arts and cultural leaders and organizations can increase understanding between the United States and the global Muslim community;
- A Science and Technology Initiative, which examines the role cooperative science and technology programs involving the U.S. and Muslim world can play in responding to regional development and education needs, as well as fostering positive relations;
- A "Bridging the Divide" Initiative which explores the role of Muslim communities in the West;
- A Brookings Institution Press Book Series, which aims to synthesize the project's findings for public dissemination.

The underlying goal of the Project is to continue the Brookings Institution's original mandate to serve as a bridge between scholarship and public policy. It seeks to bring new knowledge to the attention of decision-makers and opinion-leaders, as well as afford scholars, analysts, and the public a better insight into policy issues. The Project is supported through the generosity of a range of sponsors including the Government of the State of Qatar, The Ford Foundation, The Doris Duke Charitable Foundation, Lawrence Livermore National Laboratories, and the Institute for Social Policy Understanding. Partners include American University, the USC Center for Public Diplomacy, Unity Productions Foundation, Americans for Informed Democracy, America Abroad Media, and The Gallup Organization.

The Project Conveners are Martin Indyk, Carlos Pascual, Peter W. Singer, Shibley Telhami, and Bruce Riedel. Stephen R. Grand serves as Project Director, and Hady Amr is the Director of the Brookings Doha Center.

The Saban Center for Middle East Policy

The Saban Center for Middle East Policy was established on May 13, 2002 with an inaugural address by His Majesty King Abdullah II of Jordan. The creation of the Saban Center reflects the Brookings Institution's commitment to expand dramatically its research and analysis of Middle East policy issues at a time when the region has come to dominate the U.S. foreign policy agenda.

The Saban Center provides Washington policymakers with balanced, objective, in-depth and timely research and policy analysis from experienced and knowledgeable scholars who can bring fresh perspectives to bear on the critical problems of the Middle East. The center upholds the Brookings tradition of being open to a broad range of views. The Saban Center's central objective is to advance understanding of developments in the Middle East through policy-relevant scholarship and debate.

The center's foundation was made possible by a generous grant from Haim and Cheryl Saban of Los Angeles. Ambassador Martin S. Indyk, Senior Fellow in Foreign Policy Studies, is the Director of the Saban Center. Kenneth M. Pollack is the center's Director of Research. Joining them is a core group of Middle East experts who conduct original research and develop innovative programs to promote a better understanding of the policy choices facing American decision makers in the Middle East. They include Tamara Cofman Wittes, a specialist on political reform in the Arab world who directs the Project on Middle East Democracy and Development; Bruce Riedel, who served as a senior advisor to three Presidents on the Middle East and South Asia at the National Security Council during a twenty-nine year career in the CIA, a specialist on counterterrorism; Suzanne Maloney, a former senior State Department official who focuses on Iran and economic development; Stephen R. Grand, Fellow and Director of the Project on U.S. Relations with the Islamic World; Hady Amr, Fellow and Director of the Brookings Doha Center; Shibley Telhami, who holds the Sadat Chair at the University of Maryland; and Daniel Byman, a Middle East terrorism expert from Georgetown University. The center is located in the Foreign Policy Studies Program at Brookings, led by Brookings Vice President Carlos Pascual.

The Saban Center is undertaking path breaking research in five areas: the implications of regime change in Iraq, including post-war nation-building and Persian Gulf security; the dynamics of Iranian domestic politics and the threat of nuclear proliferation; mechanisms and requirements for a two-state solution to the Israeli-Palestinian conflict; policy for the war against terrorism, including the continuing challenge of state-sponsorship of terrorism; and political and economic change in the Arab world, and the methods required to promote democratization.

The front cover of this report includes an illustration of an astrolabe, which was used during early Islamic times to measure time and astronomical distances. Although its origins can be traced back to 3rd century B.C. Greece, it developed predominantly in the Arab world between the 8th-10th centuries and was used to determine prayer times, the direction of the Kaaba in Mecca, and to set the calendar. It was later passed on to European and other countries and was widely used up until the 17th century.

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